ASSESSMENT REPORT

ON THE

PROSPECTING, GEOLOGICAL, GEOCHEMICAL AND GEOPHYSICAL

WORK DONE ON THE

ORION CLAIM

KAMLOOPS MINING DIVISION

N.T.S. 83D/3E

LAT. 52 08 00
LONG. 119 11 00

OWNER/OPERATOR: Gary Johnston

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AUGUST, 1990

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INTRODUCTION

This report details prospecting, geological, geochemical and geophysical work done on the Orion group of claims. The property was staked in September of 1989 by Gary Johnston to cover an area of mineralization associated with an ultramafic intrusive.

Additional prospecting, hand trenching and sampling was done in the fall of 1989. Geochemical results obtained during the winter were encouraging; therefore, a detailed program was designed for the summer of 1990.

The 1990 program consisted of detailed geological mapping, rock chip geochemical sampling, petrographic analysis and geophysical surveys.

The Orion group originally consisted of five 2-Post claims, Orion 1 to Orion 5. In July of 1990, 11 more 2-post claims were staked surrounding the original five. Orion 1 to Orion 16 have been grouped for assessment purposes.

LOCATION AND ACCESS

The claims occur in NTS map sheet 83D/3E at approximately 52 degrees 8 minutes latitude and 119 degrees 11 minutes longitude. The property is in the Monashee Mountains about ten kilometers northeast of the town of Blue River.

Access to the property is by the Redsand logging road. The entrance to this road is just north of the Blue River airport on highway #5. This logging road cuts through the center of the lower third of the property at 14.2 Km. At 13.8 Km. a logging road travels north giving access to the northern third of the claim blocks.

Active logging is taking place in the valley so the Redsand road is well maintained. However, washouts are frequent in the spring, so travel should be avoided when the snow is melting.

TOPOGRAPHY AND CLIMATE

Relief within the claim area ranges from 760 to 1950 meters above sea level. Steep cliffs outline the southern boundary of the property. Slopes of 25 degrees are common within the claim block. Mature hemlock, cedar, fir and pine cover the lower and central portions. Two large clear cut areas provide easy access to approximately one half of the claim block.

Precipitation averages 130 cm. per year, much of this being snow. Because of the steep hillsides and the heavy precipitation, dirt roads are often washed out.

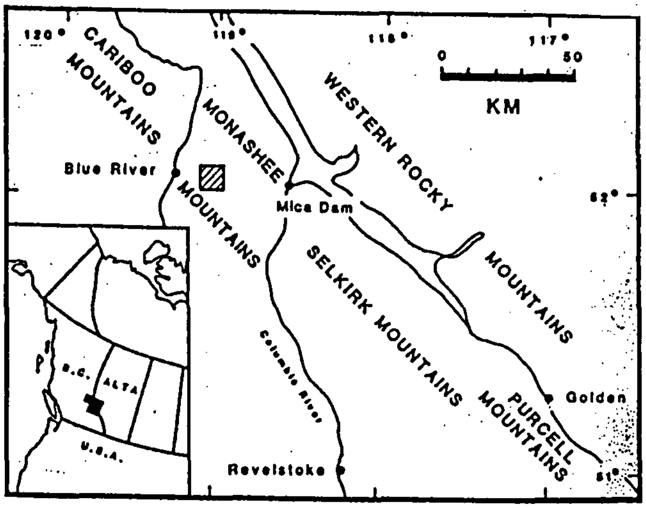
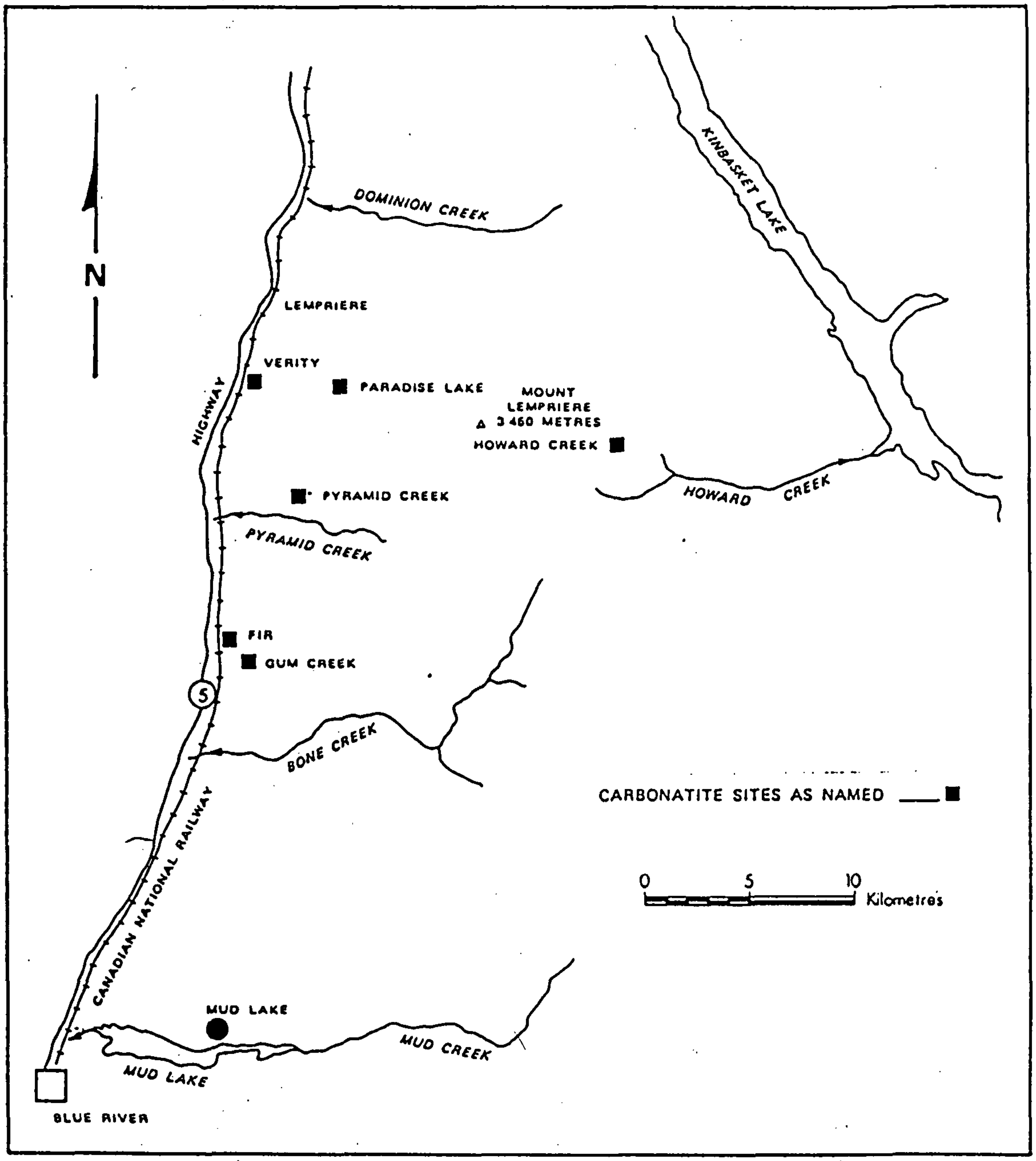


Figure 1 LOCATION MAP

Blue River Area

Orion Group ●



3A.

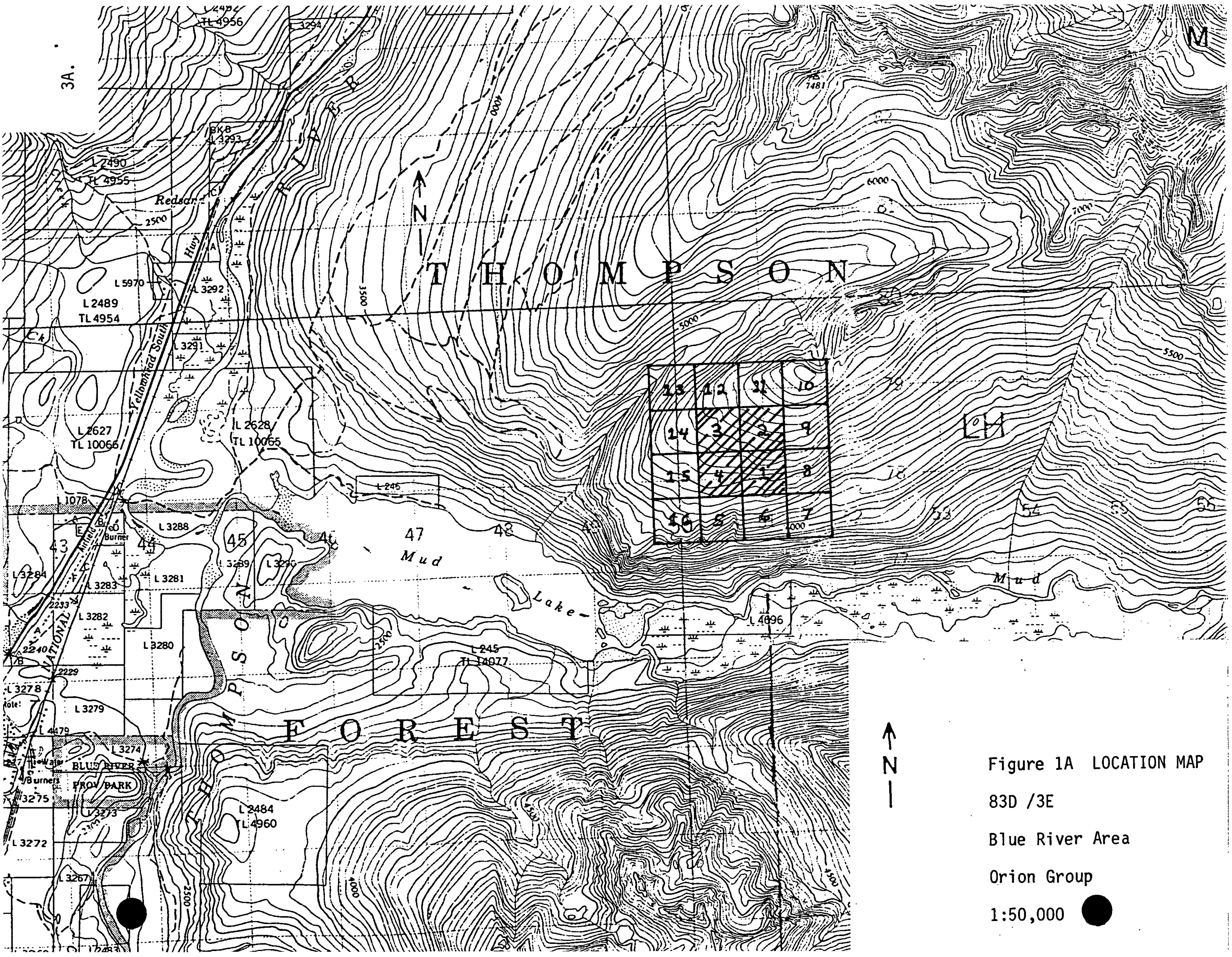


Figure 1A LOCATION MAP

83D /3E

Blue River Area

Orion Group

1:50,000

CLAIM HISTORY

The site was staked on Sept. 23, 1978 by John Morton and Alan Grant. Four 2-Post claims (AEG #1, #2 and JTM #1, #2) were staked to cover an anomalous radiation reading taken along the Red Sands Logging road (Morton, 1979). In May, 1979, two additional claims (JTM #3 and JTM #4) were added. An assessment report (AR 7783) was produced in 1979 covering prospecting in the area.

The area was restaked by W. Weyman for Bristol Resources Corp. in November, 1981 (Gift 1 and Gift 2 claims).

In September 1984 the area was restaked as the Prince claims by William Bailey.

July 18, 1987 a 20 block mineral claim was staked covering the area by Ellis Goodland (REE 8 claims).

In all cases, very little work was done to determine the exact form of the mineralization.

In the various government reports, the site is referred to as the "Mud Lake Carbonatite deposit".

REGIONAL GEOLOGY

No detailed regional geology surveys have been done in the area of the property. Detailed regional surveys have been completed south of the Mud Creek valley Sevigny (1987); Sevigny, Ghent (1986) and Sevigny, Simony (1989). The area north west of the town of Blue River to the area of the Premier range has been studied by Pell and Simony (1987). The area south of the Malton Gneiss to the Moonbeam creek area has been evaluated by Morrison (1979). Many authors have written about the Mica dam area to the east.

Originally, the rocks in the Blue River prospect area were mapped as the Kaza Group, belonging to the Windermere Period of late Proterozoic age (Campbell, 1967). Campbell mapped an inferred sillimanite isograd running east-west south of the property, along the base of the Mud Creek valley. Also, an inferred staurolite-kyanite isograd was shown running east-west following the ridge north of the property.

South of the Mud Creek valley Wheeler (1965) and Campbell (1964) have traced complexly deformed metamorphic rocks continuously to the region where the Shuswap Metamorphic Complex was originally studied. Within the southern area the Shuswap Metamorphic Complex is formed mainly, if not entirely, from rocks of Windermere age. The latter merge with and become indistinguishable from those of the metamorphic complex north of Mud Creek. The boundary of the Shuswap Metamorphic Complex is taken as the sillimanite isograd within which the gneissose rocks, with much associated pegmatite, are typical of the complex to the south. Lower grade rocks north of the sillimanite isograd are less complexly deformed, have little or no associated pegmatite, and are schistose rather than gneissose.

Recent work (Pell (1984), Pell and Simony (1981, 1982) has strongly suggested that the area mapped as Kaza Group by Campbell (1967) is actually the Horsethief Creek Group. It is also suggested that this formation extends through the claim area.

Pell and Simony (1987) indicate that strata of the Hadrynian Windermere Supergroup were deposited along the western margin of the ancient North American continent at some time between 900 and 570 Ma. They suggest that two grit-shale-carbonate packages were developed, the second deposited above and outboard of the first. In south-central British Columbia, the first deposited wedge is represented in various localities by the lower 75% of the Horsethief Creek Group, the lower Miette Group, and the Monk formation. The upper portions of the Horsethief Creek Group, the middle and upper Miette Group, the Three Sisters Formation, and the Kaza and lower Cariboo Group sediments constitute the second and younger wedge.

The two clastic wedges were deposited on a divergent or Atlantic-type margin. Actual rupture of the continental crust need not have occurred prior to Hadrynian sedimentation, and these strata were deposited on quasi-continental crust. Continental separation and the formation of depositional basins could have been accommodated through thinning of the continental crust, both through extensional faulting and ductile stretching.

In central British Columbia, the Hadrynian Windermere Supergroup strata were deformed and metamorphosed during the Late Jurassic Columbian Orogeny. Metamorphic grade locally reaches sillimanite zone of the upper amphibolite facies. Where the rocks have been intensely metamorphosed and deformed, many of the sedimentological features have been destroyed, but the stratigraphic relationships remain intact and identifiable upon careful inspection.

A number of authors have suggested that three stages of folding have taken place in the area (Simony et Al (1980), Pell and Simony (1987)). The area is dominated by northwest-plunging, second-generation folds (F2). They are everywhere superimposed on the upright limb of a major, first-generation (F1), southwest directed fold nappe. Folding also occurred after the peak of metamorphism, but only to a minor degree, and the map pattern is largely unaffected by the later folding events.

Metamorphism began during the first deformation phase as indicated by muscovite and biotite which define a schistosity that is axial planar to F1. Indicators suggest that the higher metamorphic grades were reached late in F2 but that the metamorphic grade was lower again during F3.

Personal communication (Sevigny) suggests that the claim area would be composed mainly of rocks of the Semipelite-Amphibolite Division of the Horsethief Creek Group (Table 1).

Analysis of satellite imagery and air photos suggest that a series of parallel faults or lineaments run through the area. The orientation is northeast-southwest. The largest lineament causes Mud creek to change its direction of flow. This structure can be traced southwest to Adams Lake. Many of the lineaments can be traced across the mud creek valley. The Mud Creek valley appears to be part of a major lineament that can be traced from Vancouver Island into Alberta.

TABLE 1

Summary of Hadrynian (Horsethief Creek Group) Stratigraphy

Upper Clastic Division	- 1000-2000m. Semipelite, pelite quartzite, grit semipelite, pelite, carbonate
Carbonate Division	- 20-300m. Marble, calc-silicate calc-schist, semipelite
Semipelite-Amphibolite	- 600-1500m. Platy semipelite, pelite and para-amphibolite, ortho-amphibolite sheets
Lower Carbonate Unit	- 1-100m. Gray and brownish laminated marble, coarse massive lenses, quartzose marble and calc-silicate beds; Semipelite and pelite beds are common. Best marker bed.
Lower Pelite Division	- 400-800 m. Dark pelite (Al and Fe rich) (Dark mica schist, slate (blue grey)) semipelite, psammite coarse psammite and grit in lower part calcareous conglomerate near top
Grit Division	- 500-3000 m. Feldspathic grit, coarse psammite and conglomerate interbedded with pelite and semipelite, minor carbonate and calc-silicate
..............................Mylonite zone at contact............	
Malton Gneiss	- Grey, granitoid hornblende and biotite gneiss with amphibolitic lenses and layers; local zones of mica schist with metasedimentary aspect.

LOCAL GEOLOGY

SUMMARY OF PREVIOUS WORK

Assessment report 7783 (Morton, 1979) indicates that the property was staked after the discovery of a radiation anomaly along the Redsands logging road. The source of the radiation was a weathered brick red colored material in the ditch.

The outcrop was described by Morton as a dolomite containing diopside, biotite and pyrochlore. This unit was overlaid by a marble containing albite, hornblende and magnetite. Both units are in turn overlaid by a plagioclase biotite amphibole schist. The marble and dolomite were truncated on the west side by a block of pegmatite containing muscovite.

Two rock samples from this outcrop were analyzed. Sample BR-1 was described as a carbonatite with the following analysis: U-116 ppm, Th-19 ppm, Ti-200 ppm, Sr-3500 ppm, P-2%, Nb-300 to 1000 ppm. Sample BR-2 was described as a pegmatite with similar chemical analysis.

White (1981) described the Mud Lake occurrence as follows: "Minerals identified in carbonatite on the JTM property (Mud Lake) are calcite, dolomite, apatite, ilmenite, olivine (ferroan forsterite with secondary iddingsite and goethite), tremolite-actinolite, chlorite, antigorite, vermiculite, talc, hydromica and pyrrhotite along with previously reported phlogopite, chondrodite, pyroxene, magnetite and limonite."

In a second paper, White (1984) wrote that the Mud Lake occurrence was typfied by chondrodite, diopside and garnet. He indicated that vertical mineral zoning was apparent in the weathered outcrop.

Descriptions of these rock units were not systematically recorded; therefore, it was difficult to verify the finding of previous studies on the property.

PRESENT WORK

Initial investigation of the Mud Lake area occurred in June 1989 when the author undertook an examination of the radiation anomaly associated with a carbonatite reported by Morton (1979). Radiation levels were found to be approximately 3 times the background values, much lower than those recorded by Morton (1979).

This difference could be attributed to variations in measurement geometry or to erosion along the road-cut since 1979.

An ultramafic intrusive was discovered approximately 100 meters above the original carbonatite discovery (Line 1+46West, Station 4+48South). A second radiation high was located along the upper logging road (Line 1+45West, Station 0+62North). Hand samples were taken at each site for geochemical and petrographic examination. Staking of the ORION CLAIMS was initiated in September, 1989 based on positive geochemical results from these samples.

During the spring and summer of 1990, the area was studied in detail. Map 1 (in pocket) shows the results of the geological mapping. The following interpretation of local geology is based on information shown on the map and on the results of petrographic examinations.

STRUCTURAL GEOLOGY

The entire mountain appears to be a tilted block that slopes down from north to south at approximately 25 degrees from the horizontal. The north and south edges of the mountain are truncated by sharp cliffs. The west side is defined by a sharp slope down to a small unnamed creek. Air photos show that the creek valley follows a fault zone. The east side of the mountain is not as clearly defined. A north-east/south-west trending cliff along the east side may follow a fault zone; however, this could not be confirmed.

Minimal overburden in this area allowed numerous outcrops to be examined. Bedding is uniform with a typical strike of 190 degrees and a dip of 34 degrees with little evidence of folding. In the eastern portion of the claim blocks, the outcrops are broken up and may be slump blocks or faulted remnants.

Air photo interpretation suggests the presence of a series of parallel faults through the mountain. One fault strikes 200 degrees with a dip of 65 degrees and is observed on the north face of the mountain. It can be followed down the mountain as a slump region approximately 50 to 75 meters across and it passes through the area of the discovery carbonatite and ultramafic intrusive. The fault appears to be of recent origin.

PETROLOGY

The country rock is mostly a quartz feldspar mica gneiss with occasional zones of amphibolite. This corresponds to the semipelite-amphibolite unit of the Horsethief Creek Group described in the regional geology. These metasediments outcrop on the west and east portions of the mountain.

The major portion of the mountain appears to be a large alkaline/ultramafic igneous intrusive complex. The complex covers most of the four claim blocks studied. Prospecting on the east and west suggests that the complex is approximately 1 km. wide and at least 1 km. long. The total extent of the complex to the north and south has not been defined due to the lack of outcrops and geophysics.

The center of the complex is occupied by ultramafic intrusives, varying from pyroxenites to peridotites and dunites and their altered equivalents. Petrographic studies show that the ultramafic complex is composed of fine grained rounded crystals of olivine, often partially altered to serpentine, with varying amounts of fine grained calcareous matrix. Phlogopite, orthopyroxene, magnetite, ilmenite, chromite, pyrrhotite, pentlandite and chalcopyrite occur as accessory minerals. Chrome spinels were occasionally identified.

The ultramafics are surrounded by gabbros grading into amphibolites (possibly hornblendites). The gabbros are composed of approximately equal amounts of pyroxene and calcic plagioclase. Pyroxene shows some alteration to fibrous amphibole and biotite. The amphibolites are composed of hornblende with interstitial plagioclase and occasionally quartz. Biotite always occurs as an alteration of hornblende. Magnetite and small amounts of pyrrhotite occur as accessory minerals along with sporadic amounts of sphene, zircon and rutile.

Outcrops of carbonatites lie along the outer edge of the ultramafic/amphibolite complex. Three areas of carbonatites have been identified. The central carbonatite (original discovery - Site A) is a medium grained equigranular grayish colored dolomite (beforsite) with euhedral crystals of greenish mica and elongated pods of ilmenite. Irregular stringers of pyrrhotite/pentlandite occur with the ilmenite. The eastern carbonatite (Site C) is composed of fine to medium grained calcite (sovite) with discontinuous layers of biotite and traces of euhedral zircon. This carbonatite shows the typical buff to red weathering surface associated with the carbonatites of the Mud Lake site. The carbonatite becomes apatite-rich to the west where it grades into a nepheline syenite. The northern carbonatite (Site B) is similar to the eastern but is more intensely altered with stringers of brick red iron oxide throughout. All the carbonatites are associated with nepheline syenite and/or ijolite. Calc-silicate skarn surrounding the carbonatites may also be associated with the carbonatite, probably as an alteration of the intruded metasediments. The skarns have a granoblastic texture composed of diopside, potassium and plagioclase feldspar with varying amounts of calcite, apatite, graphite, sulphides and layers of sheared cherty quartz.

Pegmatites composed of coarsely crystalline orthoclase and albite with stringers of quartz have been found on the east and west sides of the complex. The pegmatites on the east side grade into granites.

The Orion Claims appear to be part of a large igneous alkaline intrusive complex composed of a ring-like structure of ultramafics and carbonatites.

MINERALIZATION

Quantities of nickel, copper, gold, chromium, titanium and rare earth elements have been found in various rock units within the Orion Claims. The results of chemical analyses are given in Appendix B.

Nickel

Nickel values up to 1700 ppm have been reported from the ultramafic rocks. Limited assaying for platinum group elements showed up to 25 ppb Pt and 21 ppb Pd associated with the nickel.

Petrographic studies on polished thin sections show that pentlandite occurs throughout most of the ultramafic rocks as flame-like lamallae within pyrrhotite or as discrete masses, usually as inclusions in olivine or serpentinized stringers. Most pentlandite (and pyrrhotite) appears to have formed early in the crystallization sequence and often occurs rimmed by later magnetite or chromite.

Pentlandite has also been identified in the central carbonatite where it occurs with ilmenite and also in the calc-silicate skarn.

Copper

A copper value of 1700 ppm was detected in a gneissose rock adjacent to the central ultramafic. Copper occurred in chalcopyrite and traces of bornite. Chalcopyrite was observed along with pyrrhotite and pentlandite in most of the ultramafic rocks examined in polished thin section. Unlike the nickel mineralization which appears to have occurred early in the crystallization sequence, chalcopyrite appears to be remobilized and occurs along mineral cleavages and fractures in secondary fibrous amphibole.

Traces of chalcopyrite have been detected in virtually every rock type examined on the claim site.

Gold

The highest gold value (380 ppb) was found in the chalcopyrite bearing gneiss adjacent to the ultramafic. In addition, petrographic studies have found particles of free gold in serpentinized olivine of the ultramafic intrusive.

Chromium

Chromium values up to 6700 ppm as chromite and occasionally chrome spinel occur in the ultramafic rocks.

Titanium

Titanium occurs in ilmenite. A value of 2.87% TiO_2 was found in a sample of the central carbonatite. In addition, thick pods of ilmenite were found sporadically dispersed within the carbonatite. Minor quantities of ilmenite are also observed in the ultramafic and calc-silicate rocks.

Rare Earth Elements

The highest amounts of rare earth elements were detected in the central carbonatite and associated weathering products. Apatite-rich rocks associated with the carbonatite also show anomalous rare earth elements. Energy dispersive x-ray analysis of a sample of the central carbonatite showed that the rare earth elements occurred as phosphates.

Summary

Chemical and petrographic analyses of surface samples from the Orion Claims show the presence of a variety of ore minerals. Nickel as the sulphide pentlandite, copper as chalcopyrite and gold have been observed in the ultramafic rocks. The carbonatites have a potential for rare earth elements along with titanium.

Low grade mineralization has been found in all rock types on the claims. In addition to the mineralization previously described, potential exists for tantalum, niobium, phosphate, cobalt and graphite.

GEOLOGICAL MODEL

The total volume of carbonatites in the crust of the earth is believed to be very small, yet carbonatites are widely distributed on the continents and are also found on some oceanic islands. Intrusive carbonatites usually occur within ring-fracture intrusions and are associated with alkalic pyroxenites, ijolites, syenites and fenites. Kimberlites and other ultramafic intrusives may also be genetically associated with a carbonatite complex. Rocks of carbonatite-ijolite-nephelinite association are of interest because they may contain minerals of economic enrichments of one or more of the following elements; Al, P, Ti, F, Fe, Cu, Zr, Nb, Ba, REE, Th and U.

Carbonatites, along with other alkaline associations, are typically found in or near rift structures, for example, the East African Rift System, Baikal Rift System of the USSR, the Rhinegraben, the St Lawrence Paleorift and along the rifted continental margins of the South Atlantic. Rocks of the carbonatite-ijolite-nephelinite association are usually located on crustal swells. Carbonatites range in geologic age from early Precambrian through to recent times.

A carbonatite of economic importance that shows similarities to the Orion structure is the Palabora Complex of South Africa. The Palabora complex consists primarily of micaceous pyroxenite, a diopside-phlogopite-apatite rock with apatite contents up to 15%. The overall form of the complex is that of three adjacent composite pipes: a northern body of serpentine and vermiculite; a southern pipe of pyroxenite with apatite; a central pipe that is a sheeted structure of carbonatite and foskorite. The central pipe is of greatest economic interest with copper mineralization throughout the carbonatites. Magnetite, ilmenite and apatite are also recovered along with sulphur and gypsum.

The Orion structure, unlike other carbonatites recognized in the area, appears to have a ring structure with carbonatites hosted by ultramafic dunite, pyroxenite and serpentinite. Sulphide mineralization, principally pentlandite and chalcopyrite, occurs throughout the complex along with local concentrations of ilmenite and apatite.

GEOPHYSICAL SURVEY

a) SURVEY PARAMETERS

A grid was surveyed on Orion 1, 2, 3, and 4 using a compass and hip chain. The grid was installed using north-south lines with a 50 meter spacing and stations 25 meters apart. Flagging, with line and station information written on it, were tied to trees or bushes.

A magnetometer and a gamma ray spectrometer survey was conducted along the grid. A total of 904 magnetometer readings and 866 radiometric readings were obtained on the 21 km. of lines. Readings were obtained at each primary station and anomalous areas were investigated by additional readings between the primary stations.

Following the normal procedure of geophysical surveys, a number of tie backs were conducted by reading at previous stations. Diurnal corrections were made on the magnetic data when required. The variations measured were prorated over time.

b) INSTRUMENTAL PARAMETERS

Magnetometer

- Scintrex Model MP-2
- Proton Precession
- Range 20,000 to 100,000 nanoTesla
- Accuracy - 1 nanoTesla TOTAL FIELD
- Sensor - omnidirectional, noise cancelling dual coil

Magnetometers are used to detect perturbations in the geomagnetic field created by buried ferromagnetic material. An induced magnetization is produced in any material with a high magnetic susceptibility within the Earth's magnetic field. If strong enough, this induced field produces a localized anomaly in the geomagnetic field. The proton precession magnetometer measures the oscillation frequency of protons in the hydrogen atom. If the geomagnetic field was strong, the protons will precess or oscillate quickly in an attempt to line up their magnetic moments with the field. If the field was weak, the oscillation rate would be slower. As they oscillate, a radio signal will be emitted. Measuring the frequency of this signal allows the calculation of the strength of the geomagnetic field.

Gamma Ray Spectrometer

- McPhar Model TV-1A
- 1 1/2 inch sodium iodide crystal
- three threshold levels
  - Tl at 0.2 Mev

- T2 at 1.6 Mev
- T3 at 2.5 Mev
- Time Constants
  - Tl F (fast) - 1 second
  - Tl S (slow) - 10 seconds
  - T2 - 10 seconds
  - T3 - 10 seconds

Gamma rays entering the crystal interact with the crystal atoms, resulting in free electrons and a light emission (scintillation). The optically coupled photomultiplier converts the light emission to electrical pulses. The magnitudes of the electrical pulses is related to the energy level of the intercepted gamma rays. Various radioactive elements have characteristic gamma energy spectrums. Thorium emits gamma rays with energy levels exceeding 2.5 Mev. Therefore the T3 setting would make the instrument a Thorium detector. T2 will detect Thorium and Uranium. The Tl setting will detect Potassium, Thorium and Uranium. For this survey the Tl fast setting was used.

GEOPHYSICAL INTERPRETATION

RADIOMETRIC MAP

The radiometric map (Map 3 - pocket) shows a number of interesting anomalies.

The anomaly at L 1+50W S 4+50S is approximately 3 times the background value of 22 cps. This is the original carbonatite discovery site (site A). This anomaly appears to be part of a radiation high running NW-SE. The portion of this high around L 3+75W S 4+25S was identified in the field as a pegmatite.

The radiation level at L 1+50W S 0+50N is approximately 4 times the background value. This location has also been identified as a carbonatite site (site B). It also appears to be part of a weak NW-SE radiation high.

The third carbonatite site at L 1+94E S 4+95S (site C) has no obvious radiation associated with it. The carbonatite samples collected here did not show any appreciable radioactive content when tested.

A carbonatite float sample was discovered at L 2+50E S 4+90S. No outcrop could be found. This may be related to the weak radiation high that runs from L 2+50E S 4+75S to L 3+50E S 4+00S.

Pegmatites occur in the area of the anomaly at L 3+00W S 5+00N. However being on the edge of the survey area, further work should be done to the north.

Overburden will absorb the radiation from a bedrock source. It should be noted that the three carbonatite sites discovered to date were exposed by bulldozers during road construction.

The south-west portion of the survey area appears to be above the regional background. There are two possible explanations. The first is that pegmatites make up much of the rock in this area. The second is that the thickness of the overburden appears to be less in this region.

MAGNETIC MAP

The magnetic map shows no obvious fault zones (elongated trends with highs on one side and lows on the other side). The faults that were discovered by field geology do not appear to have a magnetic expression. The series of highs that run from L 4+50E S 4+25S to L 0+25E S 3+25N may indicate a fault. However no field evidence would suggest this to be true.

Figure 2

3-D Magnetic Map

View from the south-east

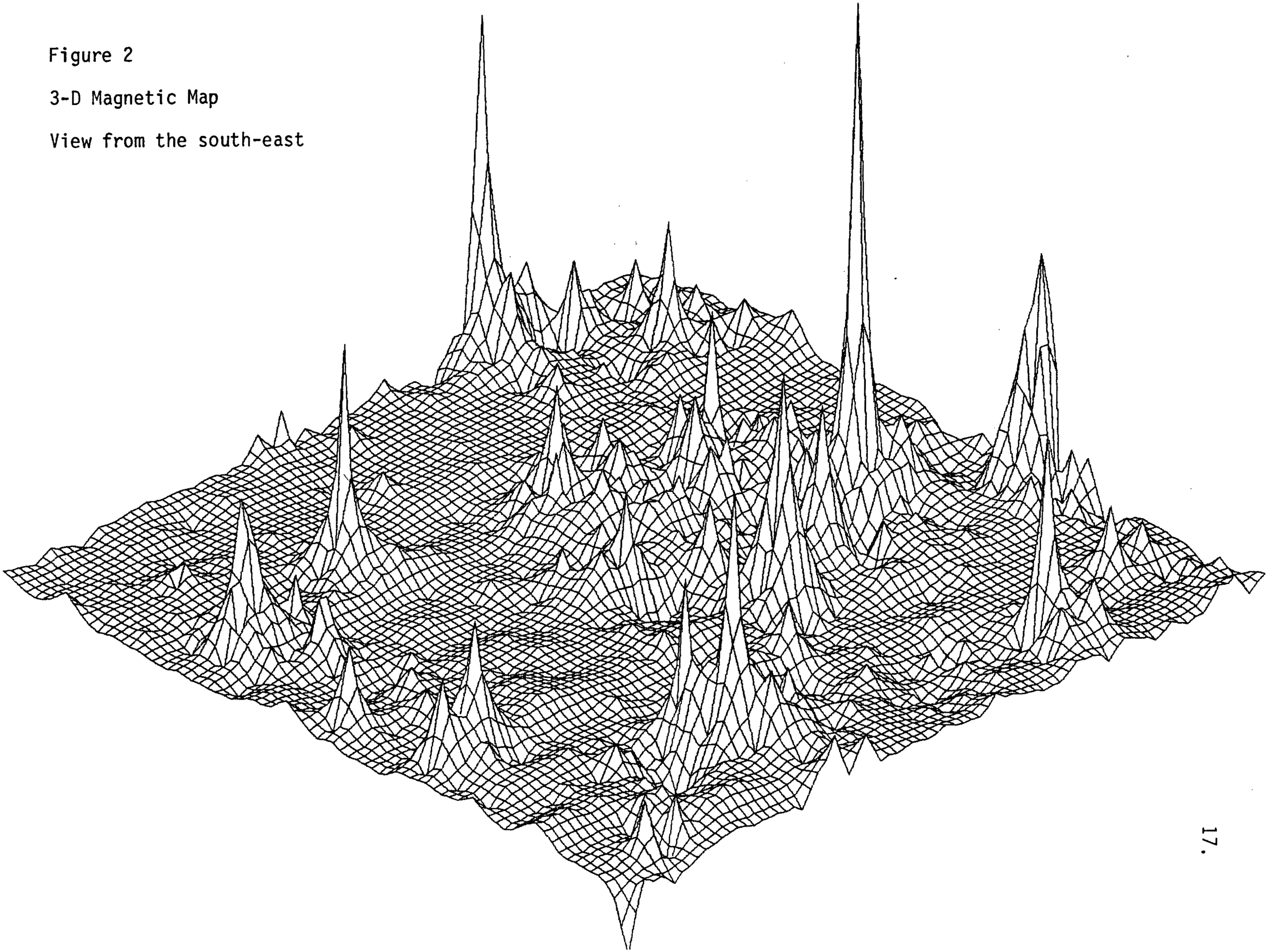
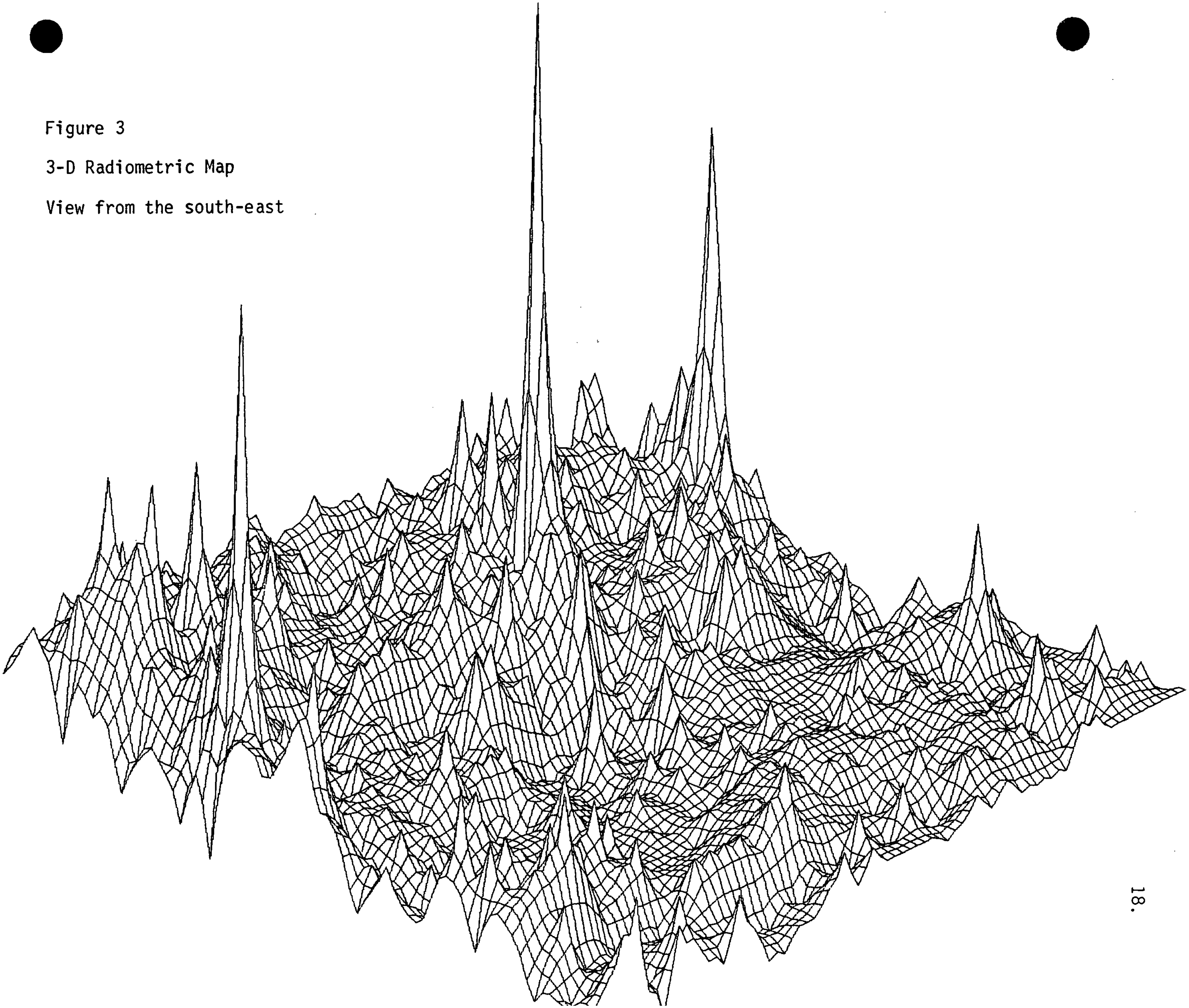


Figure 3

3-D Radiometric Map

View from the south-east



There are no obvious rock contacts indicated by the magnetics. The anomalies appear to be isolated highs in a rather flat background. This would make sense, considering that the sources are intrusives (ultramafic and carbonatite) that are injected into the country rock composed of metasediments.

The magnetic map shows a large high region centered on L 0+00 S 1+50N. The 3 dimensional plot (Figure 2) suggests that this central high is surrounded by an outer ring of high values. The radiometric 3-D map (Figure 3) also suggests a ring structure although it is not as clear. This would support the model of a carbonatite complex. The center is composed of ultramafic intrusives, surrounded by carbonatites, then nepheline syenites, pegmatites and granites.

The carbonatite sites (site A, B, and C) are not magnetic and in fact may be associated with magnetic lows.

The small anomaly at L 1+40W S 3+55S is the discovery ultramafic.

The anomaly at L 0+25E S 3+25N was trenched after high magnetic values and ultramafic float were discovered in the area. It is an ultramafic which appears to be altered to gabbros then amphibolite as you travel outward.

The anomaly at L 2+25W S 4+00S was also trenched. The rocks found here are altered skarn (perhaps altered nepheline syenite) and altered ultramafics. There was evidence in the trench of a fault dipping to the east and the rocks showed the effects of shearing.

The line of positive anomalies could be explained by a model in which the source of the magnetism is conformable with the bedding. Although the bedding in this area has a strike of 190 degrees, the magnetic anomaly could run to the south-east if the source was plunging to the south. The magnetic anomaly does appear to broaden as it runs to the south-east and this may indicate that it is getting deeper.

Most of the anomalies on the map have sharp slopes which would suggest that they are shallow.

The source of the magnetic anomalies at L 1+50E S 5+00N, L 3+50E S 1+90S, L 1+50E S 0+90N, and L 5+00W S 2+50N have not been identified. Further work should be done in these areas.

CONCLUSIONS

The geological and geophysical data collected on the Orion group of claims is very positive. Low grade mineralization and unexplained geophysical anomalies suggest that further work should be done. Geological and geophysical surveys should be extended to the area around the 4 central claim blocks. Geophysical anomalies should be trenched or drilled.

The similarities of the Orion group to carbonatite complexes around the world that contain economic mineralization is striking.

APPENDIX A

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APPENDIX B

GEOCHEMICAL DATA

GEOCHEMICAL ANALYSIS

Rock samples were analyzed using three methods; INAA (Au + 34), INAA + ICAP (52 elements) and ICP/MS.

The INAA and the INAA(ICAP) analysis was done at Activation Laboratories in Ancaster, Ontario.

The INAA method stands for Instrumental Neutron Activation Analysis. It is an analytical technique which is dependant on measuring gamma radiation which is emitted by the radioactive isotopes produced by irradiating samples in a nuclear reactor. Each element which is activated will emit a "fingerprint" of gamma radiation which can be measured and quantified. The advantages to using the INAA technique include:

1. No chemistry is required.
2. INAA is a multielement technique capable of determining up to 35 elements simultaneously.
3. INAA is exceptionally sensitive to a number of trace elements including gold, the rare earths, platinum group metals and many other elements like arsenic, antimony, tantalum, uranium, thorium, etc.

The Inductively Coupled Plasma Emission Spectrometry (ICAP) technique relies on placing the sample material into solution using either single acid, mixed acids or fusion techniques using fluxes. The sample solution is then introduced into a radio frequency excited plasma (8000 degrees K). Each element in the solution produces a characteristic spectrum. The intensity of the spectral lines are proportional to the quantity of the element present. The advantages of this technique include:

1. ICAP is a multielement technique.

2. Elements determined by ICAP are very complimentary to the INAA method.

The ICP/MS analysis was done at Acme Analytical Laboratories in Vancouver B.C. This method was used to determine a number of elements not included in the INAA + ICAP method. The ICP/MS method couples a mass spectrometer to the ICP instrument. The mass spectrometer separates elements in a magnetic field due to their mass. This allows the detection of elements that are difficult to detect with the ICP alone. This is due to the interference from other elements.

DESCRIPTION OF GEOCHEMICAL SAMPLES

89-02-18 - Location L 1+46W S 4+48S
Red soil collected at original radiation anomaly

89-10-18 - Location L 1+46W S 4+48S
Nepheline Syenite collected at radiation anomaly

89-02-17 - Location L 1+23W S 3+57S
Ultramafic Intrusive (Dunite or Mica Peridotite)
Polished thin section done

89-10-17 - Location L 1+23W S 3+57S
Ultramafic Intrusive - soil sample - weathered ultramafic

89-02-02 - Location L 1+00W S 4+50S
Soil sample - area of higher radiation

89-02-04 - Location L 0+37W S 5+10S
Hydrothermal area near fault - massive Quartz and Zircon

89-10-04 - Location L 0+37W S 5+10S
Hydrothermal area near fault - Chalcedony

89-10-19 - Location L 1+45W S 0+62N
Soil sample - red weathered - radioactive high

89-02-19 - Location L 1+45W S 0+62N
Carbonatite float - radioactive high - Polished thin section done

89-02-13 - Location L 3+00W S 4+55S
Nepheline Syenite - on edge of large area identified in the field as pegmatite - Polished thin section done

89-02-15 - Location L 4+24W S 4+90S
Plagioclase Feldspar (calcium type)

89-04-07 - Location L 1+20W S 3+58S
Ultramafic Intrusive - Fire assay (lead) was also done - From face of hand dug trench

90-02-26 - Location L 0+10E S 3+15N
Ultramafic float - Fire assay (lead) was also done

89-06-28 - Location L 1+05W S 3+57S
Gneiss - disseminated sulphides (Bornite, Chalcopyrite) - next to ultramafic intrusive

89-06-21 - Location L 0+00W S 0+30S
Location not exact - near center post - sample collected before gridding - Amphibolite

89-06-41 - Location L 1+10W S 3+58S
East portion of Ultramafic Intrusive - Polished thin section done

89-06-24 - Location L 0+40E S 3+05N
Diatreme (?) - Polished thin section done

90-03-16A - Location L 0+80E S 1+30N
Skarn

90-03-16B - Location L 0+80E S 1+30N
Metasediment

90-03-13A - Location L 2+50E S 1+00N
Amphibolite (border line Gabbro)

90-04-28 - Location L 0+25E S 3+35N
Ultramafic - SUS 2.3 - density 3.41 gm/cm^3

90-04-24 - Location L 0+25E S 3+35N
Ultramafic - SUS 8.62 - density 3.25 gm/cm^3

90-04-09 - Location L 1+50W S 0+50N
Amphibolite (Gabbro?) - SUS 3.41

90-04-10 - Location Off grid
Top of north cliff
Skarn (float)

90-04-05 - Location L 1+82E S 4+50S
Carbonatite (black crystal?)

90-04-17 - Location L 1+46W S 4+48S
Highly altered material between Carbonatite and serpentized Ultramafic

90-04-18 - Location L 1+46W S 4+48S
Carbonatite?

90-04-04 - Location L 1+72E S 4+50S
Apatite (fibrous Amphibole?) - west side of Carbonatite deposit

GEOCHEMICAL ANALYSES

SAMPLE #	AU ppb	AG ppm	AS ppm	BA ppm	BR ppm	CA %	CO ppm	CR ppm	CS ppm	FE %	HF ppm
89-02-18	<5	<5	<2	<100	<1	<1	<5	38	<2	17.2	<1
89-10-18	16	<5	<2	<100	<1	2	<5	60	<2	0.21	<1
89-02-17	5	<5	5	<100	<1	3	130	6700	<2	10.2	2
89-10-17	5	<5	4	<100	<1	2	130	6400	<2	9.8	2
89-02-02	<5	<5	2	1000	5	<1	9	180	5	7.56	10
89-02-04	6	<5	<2	140	<1	2	<5	110	<2	0.74	<1
89-10-04	15	<5	<2	290	<1	<1	<5	82	<2	0.59	<1
89-10-19	<5	<5	<2	<100	<1	6	43	63	3	10.9	5
89-02-19	17	<5	<2	<100	<1	19	14	28	<2	4.88	<1
89-02-13	<5	<5	<2	<100	<1	3	<5	60	2	0.55	<1
89-02-15	<5	<5	<2	<100	<1	2	<5	140	<2	0.26	<1
89-04-07	6	<0.1	3	57	<1		130	6200	1.3		0.8
90-02-26	11	<0.1	<2	120	<1		110	2500	1.5		1.3
89-06-28	380	0.2	<2	870	<1		20	150	0.9		4
89-06-21	23	<0.1	<2	60	<1		31	1300	<0.5		1
89-06-41	71	12	10	90	1		130	6400	<0.5		1.3
89-06-24	180	22	8	180	2		53	1800	2.9		2.3
90-3-16A	5	<0.1	<2	130	<1		7	200	1.8		4.3
90-3-16B	<5	<0.1	<2	220	<1		16	140	2.6		5.2
90-3-13A	<5	<0.1	<2	180	<1		33	140	<0.5		2.7
90-04-28	30	0.2	<2	79	3		110	3000	0.9		2
90-04-24	20	0.2	3	92	<1		89	2600	0.9		2
90-04-09	10	<0.2	<2	699	<1		40	170	1.3		3
90-04-10	9	0.2	<2	2475	<1		13	71	1.3		8
90-04-05	<5	0.8	3	556	<1		26	39	<0.5		2
90-04-17	6	0.2	<2	75	<1		17	20	<0.5		3
90-04-18	35	<5	<2	<100	<1	20	60	49	<2	8.40	<1
90-04-04	<5	<5	<2	<100	<1	19	31	32	4	7.02	18

SAMPLE #	HG ppb	IR ppb	MO ppm	NA ppm	NI ppm	RB ppm	SB ppm	SC ppm	SE ppm	SN %	SR %
89-02-18	<1	<5	<5	<500	<50	<30	<0.3	100	<5		0.18
89-10-18	<1	<5	<5	54400	<50	46	0.8	0.4	<5		0.09
89-02-17	<1	<5	<5	2470	1300	<30	2.4	15	<5		<0.05
89-10-17	<1	<5	<5	2340	950	<30	0.3	14	<5		<0.05
89-02-02	<1	<5	<5	14500	<50	130	0.5	15	<5		<0.05
89-02-04	<1	<5	<5	41700	<50	<30	2.3	0.6	<5		<0.05
89-10-04	<1	<5	<5	78200	<50	<30	3.3	0.4	<5		0.23
89-10-19	<1	<5	INT	4100	<50	54	0.9	66	<5		<0.05
89-02-19	<1	<5	INT	<500	<50	<30	4.0	36	<5		0.38
89-02-13	<1	<5	<5	36400	<50	<30	0.6	1.5	<5		0.05
89-02-15	<1	<5	<5	39000	<50	<30	2.0	0.4	<5		0.07
89-04-07		<5	<5		1700	<20	<0.2	12	<3		<0.05
90-02-26	<1	<5	<5		1100	<10	<0.2	18	<3		0.008
89-06-28	<1	<5	<5		90	33	0.2	9.3	<3		<0.03
89-06-21	<1	<5	<5		60	<10	<0.2	36	<3		<0.01
89-06-41	<1	<5	<5		1590	22	25	11	<3		<0.01
89-06-24	<1	<5	<5		200	29	37	36	<3		<0.01
90-3-16A	<1	<5	<5		50	52	<0.2	8.4	<3		.014
90-3-16B	<1	<5	<5		10	56	<0.2	17	<3		.015
90-3-13A	<1	<5	<5		<10	<10	<0.2	28	<3		.019
90-04-28	<1	6	<5		1200	<10	<0.2	18	<3	<0.01	.007
90-04-24	<1	<5	<5		1100	21	0.2	17	<3	<0.01	.0079
90-04-09	<1	<5	<5		110	<10	0.2	50	<3	<0.01	.05
90-04-10	<1	<5	<5		<10	88	0.6	21	<3	<0.01	.057
90-04-05	<1	<5	<5		80	<10	0.6	27	<3	<0.01	.138
90-04-17	<1	<5	<5		<10	<10	0.7	13	<3	<0.01	.025
90-04-18	<1	<5	INT	1040	<54	<30	0.4	28	<5	<0.03	<0.05
90-04-04	<1	<5	<5	4210	<59	<30	0.6	25	<5	<0.03	0.09

SAMPLE #	TA ppm	TH ppm	U ppm	W ppm	ZN ppm	LA ppm	CE ppm	ND ppm	SM ppm	EU ppm	TB ppm
89-02-18	400	32	<0.5	<4	<50	650	700	360	44	16.8	7.3
89-10-18	<1	1.9	<0.5	<4	<50	9	13	7	1.0	1.0	<0.5
89-02-17	<1	1.2	<0.5	<4	120	5	11	<5	1.2	0.4	<0.5
89-10-17	<1	1.4	<0.5	<4	86	8	16	<5	1.3	0.4	<0.5
89-02-02	<1	26	2.3	<4	53	110	130	56	8.3	1.4	1.2
89-02-04	<1	<0.5	<0.5	<4	<50	2	4	<5	0.3	0.8	<0.5
89-10-04	<1	<0.5	<0.5	<4	<50	3	4	<5	0.2	1.2	<0.5
89-10-19	130	13	58	10	<50	310	370	190	27	8.4	1.8
89-02-19	30	5.4	21	<4	<50	200	260	140	18	5.7	0.17
89-02-13	<1	25	1.8	<4	<50	67	100	58	9.8	1.3	1.6
89-02-15	<1	2.1	<0.5	<4	<50	8	12	<5	1.0	1.0	<0.5
89-04-07	<1	0.8	<0.5	<3	90	3.7	12	<5	1.1	0.4	<0.5
90-02-26	<1	1.6	<0.5	<3		6.9	15	9	1.7	0.5	<0.5
89-06-28	2	37	2.4	<3	180	110	140	63	9.9	4.0	0.9
89-06-21	<1	1.3	<0.5	<3	65	5	8	7	1.5	0.4	<0.5
89-06-41	<1	1.0	<0.5	<3	250	5.0	12	8	1.3	0.4	<0.5
89-06-24	<1	2.3	1.1	<3	355	9.0	17	8	2.4	0.7	<0.5
90-3-16A	1	12	3	<3		29.9	57	28	4.5	1.0	0.7
90-3-16B	<1	10	2.6	<3		32.6	64	29	5.8	1.2	0.9
90-3-13A	<1	3.5	0.8	<3		14.1	29	15	3.3	0.9	<0.5
90-04-28	<1	1.6	<0.5	<3	<5	7.4	15	6	1.7	0.6	<0.5
90-04-24	<1	1.2	<0.5	<3	75	8.5	16	5	1.6	0.6	<0.5
90-04-09	2	1.4	<0.5	<3	130	95	130	49	8.5	2.7	1.2
90-04-10	<1	7.1	2.1	<3	30	40	67	31	6.2	2.1	0.8
90-04-05	21	<0.5	<0.5	<3	15	150	220	90	15	4.7	1.5
90-04-17	11	1.1	7.8	<3	180	67	110	61	11	3.9	1.4
90-04-18	12	1.9	27	<4	185	140	280	110	16	5.3	1.9
90-04-04	25	3.0	<0.6	<4	181	230	420	140	21	7.5	<0.5

GEOCHEMICAL ANALYSES

SAMPLE #	YB ppm	LU ppm	BE ppm	CU ppm	PB ppm	V ppm	NB ppm	BI ppm	ZR ppm	Y ppm	
89-02-18	8.52	INT									
89-10-18	0.65	0.15									
89-02-17	0.74	0.13									
89-10-17	0.68	0.14									
89-02-02	2.60	0.46									
89-02-04	0.59	<0.05									
89-10-04	0.25	<0.05									
89-10-19	3.67	0.34									
89-02-19	1.00	0.25									
89-02-13	1.82	0.28									
89-02-15	0.57	0.14									
89-04-07	0.6	0.11	<1	170		110			38	8	
90-02-26	1.0	0.15	<1	280	<50	120	<50	<100	50	14	
89-06-28	1.98	0.32	4	1700	300	150	650	<100	230	28	
89-06-21	1.23	0.23	<1	30	<50	240	<50	<100	60	14	
89-06-41	0.73	0.11	<1	95	100	266	<50	<100	70	8	
89-06-24	1.51	0.22	<1	105	150	202	<50	<100	90	18	
90-3-16A	2.4	0.36	2	25	<50	34	<50	<100	150	24	
90-3-16B	3.4	0.52	<1	40	<50	120	<50	<100	240	36	
90-3-13A	2.0	0.31	<1	<5	<50	250	<50	<100	110	24	
90-04-28	1.27	0.22	<1	420	<50	150	<30		51	12	
90-04-24	1.13	0.18	<1	290	<50	140	<30		56	12	
90-04-09	3.97	0.69	1	130	<50	400	60		114	43	
90-04-10	3.47	0.64	2	30	50	52	60		239	38	
90-04-05	2.58	0.47	<1	80	<50	120	60		73	39	
90-04-17	3.10	0.50	2	130	<50	74	30		87	39	
90-04-18	1.23	0.15									
90-04-04	3.03	0.41									

GEOCHEMICAL ANALYSES

SAMPLE #	SiO2 %	Al2O3 %	Fe2O3 %	CaO %	MgO %	Na2O %	K2O %	TiO2 %	MnO %	P2O5 %	
89-02-18											
89-10-18											
89-02-17											
89-10-17											
89-02-02											
89-02-04											
89-10-04											
89-10-19											
89-02-19											
89-02-13											
89-02-15											
89-04-07	42.23	3.91	12.72	3.07	34.26	.33	.31	.37	.16	.23	
90-02-26	45.50	7.04	13.61	5.13	22.94	.98	.62	.59	.17	.08	
89-06-28	54.66	17.35	11.75	2.18	3.41	3.47	1.32	1.10	.13	.54	
89-06-21	52.72	7.84	9.41	12.30	14.03	1.24	.44	.63	.17	.24	
89-06-41	40.35	4.08	10.41	2.76	35.34	.29	.32	.45	.13	.32	
89-06-24	51.80	6.43	12.09	5.54	17.94	.85	.54	.88	.20	.14	
90-3-16A	68.33	15.11	4.31	7.16	1.64	.73	.74	.45	.08	.04	
90-3-16B	66.52	14.35	6.90	6.11	2.55	1.01	1.18	.86	.15	<.02	
90-3-13A	54.17	15.01	10.73	9.85	5.43	1.70	1.04	1.07	.16	<.02	
90-04-28	45.39	6.55	13.19	4.92	27.71	.74	.34	.58	.18	.18	
90-04-24	44.77	6.89	13.65	4.89	26.39	.84	.42	.59	.18	.16	
90-04-09	47.52	13.56	15.04	11.04	6.74	1.85	.82	1.80	.23	.20	
90-04-10	62.23	13.08	7.84	5.28	1.38	1.71	5.76	1.41	.17	.28	
90-04-05	7.42	0.96	6.33	35.80	9.54	.02	.66	2.87	.17	.04	
90-04-17	47.32	1.66	9.63	24.92	10.51	.23	.22	.35	.31	3.20	
90-04-18											
90-04-04											

FIRE ASSAY RESULTS

90-02-26 - Au (6 ppb), Pt (25 ppb), Pd (21 ppb)

89-04-07 - Au (7 ppb), Pt (14 ppb), Pd (6 ppb)

DESCRIPTION OF GEOCHEMICAL SAMPLES

90-04-03 - Location L 1+75E S 4+50S
Carbonatite
SUS 1.25

90-04-04 - Location L 1+72E S 4+50S
Carbonatite (Apatite rich)
SUS 0.31

90-04-17 - Location L 1+46W S 4+48S
Carbonatite - visible titanomagnetite
SUS 5.51

90-04-26 - Location L 1+45W S 0+62N
Carbonatite
SUS 2.52

ACME ANALYTICAL LABORATORIES LTD. 852 E. HASTINGS ST. VANCOUVER B.C. V6A 1R6 PHONE(604)253-3158 FAX(604)253-1716

WHOLE ROCK ICP ANALYSIS

B-12

Cosmic Ventures File # 90-4985

Box 4056, Spruce Grove AB T7X 3B3 Submitted by: GARY JOHNSTON

SAMPLE#	SiO2 %	Al2O3 %	Fe2O3 %	MgO %	CaO %	Na2O %	K2O %	TiO2 %	P2O5 %	MnO %	Cr2O3 %	Ba ppm	Cu ppm	Zn ppm	Ni ppm	Co ppm	Sr ppm	La ppm	Zr ppm	Ce ppm	Y ppm	Nb ppm	Ta ppm	LOI %	SUM %
90-04-03	8.03	.81	6.21	12.45	34.24	.05	.41	1.57	.52	.21	.005	436	86	73	69	21	1856	133	40	211	36	20	20	35.1	99.93
90-04-04	50.53	4.74	8.77	10.67	20.31	.39	.21	1.52	.18	.20	.002	79	23	162	52	68	259	187	441	362	41	58	20	2.4	100.15
90-04-17	4.32	.10	8.78	17.96	27.70	.05	.05	.21	4.53	.38	.002	128	46	55	10	9	3686	187	21	307	29	107	20	35.4	99.99
90-04-26	6.83	.85	4.63	4.59	42.79	.09	.05	1.16	.12	.18	.005	526	114	27	80	19	1381	155	46	204	43	20	20	38.5	100.09

.200 GRAM SAMPLES ARE FUSED WITH 1.2 GRAM OF LIBO2 AND ARE DISSOLVED IN 100 MLS 5% HNO3.
- SAMPLE TYPE: ROCK

DATE RECEIVED: OCT 1 1990 **DATE REPORT MAILED:** Oct 10/90 **SIGNED BY**............D.TOYE, C.LEONG, J.WANG; CERTIFIED B.C. ASSAYERS

ACME ANALYTICAL LABORATORIES 852 E. HASTINGS ST. VANCOUVER B.C. V6A 1R6 PHONE 253-3158 DATA LINE 251-1011

B-13

WHOLE ROCK ICP-MS ANALYSIS

Cosmic Ventures File # 90-4985
Box 4056, Spruce Grove AB T7X 3B3 Submitted by: GARY JOHNSTON

SAMPLE#	Y PPM	La PPM	Ce PPM	Pr PPM	Nd PPM	Sm PPM	Eu PPM	Gd PPM	Tb PPM	Dy PPM	Ho PPM	Er PPM	Tm PPM	Yb PPM	Lu PPM
90-04-03	36	147	263	23	132	19	5	10	2	7	1	2	1	1	1
90-04-04	44	210	357	32	176	20	5	14	2	7	1	4	1	3	1
90-04-17	29	210	388	35	198	25	6	15	2	7	1	2	1	1	1
90-04-26	44	158	273	24	132	20	5	12	2	7	1	4	1	3	1

.100 GRAM SAMPLE FUSED WITH .6 GM LIBO2 AND IS DISSOLVED AND DILUTED TO 50 ML WITH 5% HNO3.
ANALYSIS BY ICP MASS SPECTROMETER
- SAMPLE TYPE: ROCK PULP

DATE RECEIVED: OCT 1 1990 **DATE REPORT MAILED:** Nov 2/90. **SIGNED BY** C. Leong ....D.TOYE OR C.LEONG, CERTIFIED B.C. ASSAYERS

APPENDIX C

PETROGRAPHIC ANALYSIS

DESCRIPTION OF PETROGRAPHIC SAMPLES

89-02-17 - Location L 1+23W S 3+57S
Dunite or Mica Peridotite
Geochemistry done

89-02-19 - Location L 1+45W S 0+62N
Carbonatite
Geochemistry done

89-02-13 - Location L 3+00W S 4+55S
Nepheline Syenite
Geochemistry done

89-06-41 - Location L 1+10W S 3+58S
Geochemistry done

89-06-24 - Location L 0+40E S 3+05N
Diatreme
Geochemistry done

89-06-16 - Location L 0+50E S 0+35S
Granite

89-06-25 - Location L 1+38W S 3+56S
Ultramafic at contact zone on west side

89-06-42 - Location L 1+38W S 3+56S
Amphibolite - west portion of intrusive

89-06-22 - Location L 1+00E S 1+00S
Location not exact - collected before grid

89-06-20 - Location L 0+00E S 0+00N
Location not exact - collected before grid

89-06-26 - Location L 2+20W S 3+90S
Magnetic anomaly - 6 ft. down in pit

89-06-45 - Location L 2+03W S 4+24S
Lower portion of outcrop
Amphibolite

89-02-01 - Location - on logging road at 10.8 km.
Skarn - Graphite

89-05-18 - Location - on logging road at 10.8 km.
Skarn - Graphite

90-02-28A - Location L 4+45W S 3+85N
Gabbro? Amphibolite?

90-02-28B - Location L 4+45W S 3+85N
Skarn?

90-04-22 - Location L 2+50W S 2+07S
Magnetic high - Sample from backhoe trench

90-03-09 - Location L 1+45W S 4+50S
Serpentized Ultramafic below Carbonatite

COSMIC VENTURES
Box 4056
Spruce Grove
Alberta, T7X 3B3

PETROGRAPHIC ANALYSIS

....

Analysis by Maureen Johnston, P.Geol.

CLIENT
GARY JOHNSTON

SPECIMEN NUMBER
89 - 02 -17 (Polished Thin Section): Fine to medium grained phaneritic granular rock, dark green in color.

DATE
February 25, 1990

....

Mineralogy

Mineral	%
OLIVINE	84
MICA	5
SERPENTINE	5
IRON OXIDE	3
MAGNETITE	1
PYRROHTITE	1
CHROMITE	1
PENTLANDITE	<1
CHALCOPYRITE	trace
GOLD (?)	trace
	100%

Mineral Descriptions

OLIVINE: Rounded crystals, approximately 1 mm. in diameter in a granulose mass. Some alteration to serpentine and iron oxide. Optical Properties: Colorless to pale yellow in plane light; upper second to third order interference colors; high relief.

MICA (PHLOGOPITE ?): Euhedral to subhedral crystals up to several millimeters in length. Occurs dispersed throughout the olivine matrix. Optical Properties: Pale yellow/brown pleochroism; third order interference colors; parallel extinction.

SERPENTINE: Occurs as very fine grained secondary mineral in veins cutting through olivine crystals. Opaque mineralization occurs mostly within veins. Some secondary carbonate may occur along with serpentine. Optical Properties: Pale green in plane light; low order interference colors--grey mainly; mottled extinction pattern.

IRON OXIDE: Very fine grained secondary mineral occurs as alteration of olivine and magnetite in fractures cutting across the minerals and as rims around pyrrhotite blebs. Optical Properties: Bluish grey color in incident light; reddish internal reflections.

MAGNETITE: Rounded crystals, approximately 500 microns in diameter. Occurs as inclusions within olivine crystals and in serpentine veins. Sulphides often occur as inclusions within magnetite. Optical Properties: Brownish grey in incident light; isotropic.

CHROMITE: Rounded to irregular and angular crystals dispersed throughout the olivine matrix. Approximately 250 microns in diameter. Optical Properties: Brown color in plane light; grey in incident light; isotropic.

PYRRHOTITE: Occurs in rounded blebs varying from 50 microns to 500 microns in diameter. Occurs in serpentine veins and as inclusions within magnetite along with pentlandite. Optical Properties: Pinkish brown in incident light; anisotropic and pleochroic.

PENTLANDITE: Occurs with pyrrhotite in rounded blebs approximately 50 to 100 microns in diameter as massive crystals. Also observed as flame-like exsolution lamallae in pyrrhotite. Optical Properties: Pale creamy white in incident light; isotropic.

CHALCOPYRITE: Occasional irregular mass along with pentlandite. Optical Properties: Lemon yellow color in incident light.

GOLD(?): One irregular shaped grain observed growing into a void between olivine crystals; approximately 20 microns in length. Optical Properties: Bright gold color in incident light; low hardness indicated by polishing pits.

Specimen Number
89 - 02 - 17 (Polished Thin Section)
....

Texture

The section is composed of a granular mass of fine to medium grained olivine crystals with euhedral mica and occasional chromite and magnetite. The crystals are fractured and the fractures and interstitial masses are filled with serpentine (and possible secondary calcite) and iron oxide. Magnetite and occasional pyrrhotite and pentlandite occurs as inclusions in the olivine but mostly within serpentine fractures.

Alteration

Alteration of olivine to serpentine and iron oxide is accompanied by pyrrhotite/pentlandite mineralization.

Petrogenesis

This rock is likely from an ultramafic intrusive. Serpentinization likely occurred subsequent to crystallization along with sulphide mineralization.

Comments

ROCK NAME: DUNITE or MICA PERIDOTITE

COSMIC VENTURES
Box 4056
Spruce Grove
Alberta, T7X 3B3

PETROGRAPHIC ANALYSIS

....

Analysis by Maureen Johnston, P.Geol.
CLIENT
GARY JOHNSTON
SPECIMEN NUMBER
89-02-19 (Polished Thin Section)
DATE

....

Mineralogy

Mineral	%
CALCITE	87
OLIVINE	5
APATITE	5
IRON OXIDE	2
MAGNETITE	1
PYRRHOTITE	<1
	100%

Mineral Descriptions

CALCITE: Coarse subhedral crystals; crystals show twinning. Optical Properties: Colorless to pale brown in plane light; extreme birefringence; rhombohedal cleavage and twinning.

OLIVINE: Rounded crystals, approximately 2 mm. in diameter. Dispersed throughout the calcite matrix. Opaque minerals occur within and surrounding the olivine grains. Optical Properties: Colorless to pale yellow in plane light; second order interference colors; cracked texture.

APATITE: Rounded crystals, varying from 0.5 to 3 mm. in diameter. Dispersed throughout the calcite matrix. Contains very small inclusions along internal fractures. Optical Properties: Colorless in plane light; first order grey interference color; moderate positive relief.

IRON OXIDE: Very fine grained secondary mineral occurs throughout olivine and surrounding apatite grains and in fractures cutting entire specimen.

MAGNETITE: Small, rounded crystals occur as inclusions in olivine Optical Properties: Brownish grey in incident light;

isotropic.

PYRRHOTITE/PENTLANDITE: Very small elongated particles; observed mostly within iron oxide in fractures cutting section. Pentlandite occurs as flame-like exsolutions within pyrrhotite. Traces of chalcopyrite and graphite are also observed. Optical Properties: Pyrrhotite is pinkish brown in incident light with pleochroism and anisotropism. Pentlandite is creamy white in incident light and is isotropic. Chalcopyrite is lemon yellow in incident light. Graphite occurs as euhedral fibres and shows extreme pleochroism and anisotropism in incident light.

Specimen Number
89-02-19 (Polished Thin Section)
....

Texture

This rock is coarse grained and has an equigranular texture produced by interlocking subhedral crystals of calcite. Rounded crystals of olivine and apatite occur throughout the calcite matrix. The entire section is cut by fractures with secondary iron oxide.

Alteration

Calcite shows rhombohedral twinning likely induced by metamorphism.
Secondary iron oxide occurs in fractures throughout section.

Petrogenesis

This rock may be a carbonatite formed by igneous activity or possibly a skarn..field relationships would be necessary to confirm the origin. Sulphides appear to have crystallized or remobilized during alteration that produced fractures and secondary iron oxide.

Comments

ROCK NAME: CARBONATITE(?)

COSMIC VENTURES
Box 4056
Spruce Grove
Alberta, T7X 3B3

PETROGRAPHIC ANALYSIS

Analysis by Maureen Johnston, P.Geol.

CLIENT
GARY JOHNSTON

SPECIMEN NUMBER
89-02-13 (Polished Thin Section)

DATE

Mineralogy

Mineral	%
K-FELDSPAR	55
NEPHELINE	20
QUARTZ	20
BIOTITE	5
SERICITE	trace
IRON OXIDE	trace
	100%

Mineral Descriptions

K-FELDSPAR: Mostly microcline. Some perthitic intergrowths with albite. Occurs as coarse columnar crystals. Intense alteration to secondary clay minerals. Optical Properties: Brown color in plane light because of secondary clays; low first order interference color; negative relief; gridiron twinning of microcline or perthitic intergrowths.

NEPHELINE: Coarse columnar crystals in equigranular texture with feldspar. Intense alteration to secondary clay minerals. Optical Properties: Brown color in plane light due to secondary clays; low first order interference color; uniaxial negative.

QUARTZ: Occurs in stringers. Individual crystals are equant to slightly elongated; approximately 1 mm. in length. Some evidence of stress; undulatory extinction. Optical Properties: Colorless in plane light; first order interference color; no cleavage.

BIOTITE: Euhedral fibrous crystals occur at contacts between quartz and feldspars/nepheline. Optical Properties: Light to dark brown pleochroism; anomalous birefringence; parallel extinction.

SERICITE: Traces observed at K-feldspar grain boundaries. Optical Properties: Colorless to pale green in plane light; third order interference colors.

IRON OXIDE: Fine grained secondary mineral along with biotite. Optical Properties: Reddish color in plane light; bluish grey in incident light; red internal reflections.

Specimen Number
89-02-13

....

Texture

The rock is phaneritic coarse grained plutonic with equigranular texture of interlocking crystals of K-feldspar and nepheline. Stringers of granoblastic quartz occur throughout. Fibrous biotite and secondary iron oxide occur at contacts between quartz and feldspar/nepheline.

Alteration

K-feldspar and nepheline have been intensely altered to secondary clay minerals. Some sericite occurs at K-feldspar contacts.

Petrogenesis

This rock is likely an igneous intrusive from an alkaline source. Quartz was introduced subsequent to crystallization.

Comments

ROCK NAME: NEPHELINE SYENITE

COSMIC VENTURES
Box 4056
Spruce Grove
Alberta, T7X 3B3

PETROGRAPHIC ANALYSIS

Analysis by Maureen Johnston, P.Geol.

CLIENT
GARY JOHNSTON

SPECIMEN NUMBER
89-06-41 (Polished Thin Section)

DATE

Mineralogy

Mineral	%
OLIVINE	63
FIBROUS AMPHIBOLE	15
MATRIX	15
ORTHOPYROXENE	3
PHLOGOPITE	2
MAGNETITE	<1
PYRRHOTITE	<1
PENTLANDITE	trace
ILMENITE	trace
CHROMITE	trace
CHALCOPYRITE	trace
GOLD	trace
	100%

Mineral Descriptions

MATRIX: Irregular masses of very fine grained fibrous minerals; likely chlorite, fibrous amphibole, carbonate and serpentine. Occurs interstitial between olivine crystals.

OLIVINE: Rounded crystals, 0.5 to 1 mm. in diameter. Occur with mica in fine grained matrix. Opaque minerals dispersed throughout, especially along stringers of asbestiform alteration. Optical Properties: Pale yellow in plane light; upper second order interference colors; high positive relief; distinctive cracks and asbestiform alteration.

PHLOGOPITE: Euhedral crystals, approximately 2 mm. in length. Dispersed throughout the section, usually within fibrous mass. Sulphide minerals, especially chalcopyrite, occur along crystal boundaries. Optical Properties: Pale reddish brown pleochroism; third order interference colors; parallel extinction.

FIBROUS AMPHIBOLE: Euhedral acicular crystals up to 4 mm. in length. Occurs between olivine crystals, likely part of the calcareous serpentine "matrix". Optical Properties: Pale green and pleochroic in plane light; second order interference colors; inclined extinction. Actinolite or similar composition.

ORTHOPYROXENE: Occasional columnar crystal with olivine. Optical Properties: Colorless or very pale greenish in plane light; first order interference colors; parallel extinction.

MAGNETITE: Rounded to elongated crystals up to 1 mm. in length. Occurs mostly in fractures in olivine. Some magnetite occurs rimming masses of pyrrhotite/pentlandite. Some magnetite is intergrown with ilmenite and/or chromite. Optical Properties: Brownish grey in incident light; isotropic.

PYRRHOTITE: Rounded blebs, approximately 100 microns in diameter; occurs with pentlandite in the matrix within fibrous minerals, usually along cleavage and fractures. Optical Properties: Pinkish brown in incident light; slightly pleochroic; anisotropic.

PENTLANDITE: Occurs with pyrrhotite in small blebs and occasionally free. Optical Properties: Creamy yellow in incident light; isotropic.

ILMENITE: Rounded masses, usually intergrown with magnetite. Optical Properties: Grey with brownish tinge in incident light; isotropic.

CHROMITE: Occasional small rounded mass; usually within olivine crystals. Optical Properties: Grey color in incident light; often has a fractured texture.

CHALCOPYRITE: Occurs occasionally with pentlandite/pyrrhotite and as thin stringers along crystal contacts in phlogopite. Optical Properties: Lemon yellow color in incident light; isotropic to slightly anisotropic.

GOLD: One small rounded crystal, approximately 20 microns in diameter, was observed as a free grain within the matrix. Optical Properties: Bright gold color in incident light.

Specimen Number
89-06-41 (Polished Thin Section)
....

Texture

This rock is phaneritic fine grained with an equigranular texture resulting from rounded olivine crystals with interstitial masses of a fibrous "matrix". Euhedral fibrous amphibole crystals often occur within the fibrous matrix or at olivine grain boundaries. Opaque minerals, including oxides and sulphides, occur as inclusions within olivine and in the fibrous matrix. Occasional thin stringers of sulphides occur within the fibrous minerals, along crystal or cleavage contacts.

Alteration

The fibrous matrix is composed of chlorite, carbonate and other fibrous minerals and likely results from the partial alteration of the original ultramafic rock.

Petrogenesis

This rock is most likely ultramafic igneous, formed by relatively slow crystallization of magma of mantle origin. The pyrrhotite and pentlandite likely crystallized early followed by olivine and magnetite. The magnetite forms rims around the early sulphides. Metamorphism subsequent to crystallization caused the alteration of some of the silicates and possible mobilization of the sulphides, especially the chalcopyrite. Gold may have been introduced during the alteration.

Comments

ROCK NAME: SERPENTINIZED DUNITE

COSMIC VENTURES
Box 4056
Spruce Grove
Alberta, T7X 3B3

PETROGRAPHIC ANALYSIS

....

Analysis by Maureen Johnston, P.Geol.
CLIENT
GARY JOHNSTON
SPECIMEN NUMBER
89-06-24 (Polished Thin Section)
DATE

....

Mineralogy

Mineral	%
MATRIX	42
OLIVINE	35
PHLOGOPITE	15
QUARTZ	5
MAGNETITE	2
PYRRHOTITE	1
PENTLANDITE	<1
ILMENITE	<1
CHROMITE	<1
CHALCOPYRITE	<1
GOLD	trace
	100%

Mineral Descriptions

MATRIX: Irregular masses of very fine grained fibrous minerals; likely chlorite, fibrous amphibole, carbonate. Often associated with phlogopite.

OLIVINE: Rounded crystals, 0.5 to 2 mm. in diameter. Occur with mica in fine grained matrix. Opaque minerals dispersed throughout, especially along stringers of asbestiform alteration. Optical Properties: Pale yellow in plane light; upper second order interference colors; high positive relief; distinctive cracks and asbestiform alteration.

PHLOGOPITE: Euhedral crystals, approximately 2 mm. in length. Dispersed throughout the section, usually within fibrous mass. Sulphide minerals, especially chalcopyrite, occur along crystal boundaries. Optical Properties: Pale reddish brown pleochroism; third order interference colors; parallel extinction.

QUARTZ: Anhedral masses, approximately 1 mm. in diameter. Occur interstitial between other minerals and matrix. Optical Properties: Colorless in plane light; first order interference colors.

MAGNETITE: Rounded to elongated crystals up to 1 mm. in length. Occurs mostly in fractures in olivine. Some magnetite occurs rimming masses of pyrrhotite/pentlandite. Some magnetite is intergrown with ilmenite and/or chromite. Optical Properties: Brownish grey in incident light; isotropic.

PYRRHOTITE: Rounded blebs, approximately 100 microns in diameter; occurs with pentlandite in the matrix, within olivine crystals and occasionally along crystal boundaries in phlogopite. Often rimmed with magnetite. Optical Properties: Pinkish brown in incident light; slightly pleochroic; anisotropic.

PENTLANDITE: Occurs with pyrrhotite in small blebs and occasionally free. Optical Properties: Creamy yellow in incident light; isotropic.

ILMENITE: Rounded masses, usually intergrown with magnetite. Optical Properties: Grey with brownish tinge in incident light; isotropic.

CHROMITE: Occasional small rounded mass; usually within olivine crystals. Optical Properties: Grey color in incident light; often has a fractured texture.

CHALCOPYRITE: Occurs occasionally with pentlandite/pyrrhotite and as thin stringers along crystal contacts in phlogopite. Optical Properties: Lemon yellow color in incident light; isotropic to slightly anisotropic.

GOLD: One small rounded crystal, approximately 50 microns in diameter, was observed as a free grain within the matrix. Optical Properties: Bright gold color in incident light.

Specimen Number
89-06-24 (Polished Thin Section)

....

Texture

This rock is phaneritic medium grained with an equigranular texture resulting from rounded olivine crystals with interstitial masses of a fibrous "matrix". Euhedral phlogopite crystals often occur within the fibrous matrix or at olivine grain boundaries. Opaque minerals, including oxides and sulphides, occur as inclusions within olivine and in the fibrous matrix. Occasional thin stringers of sulphides occur within the phlogopite, along crystal or cleavage contacts.

Alteration

The fibrous matrix is composed of chlorite, carbonate and other fibrous minerals and likely results from the partial alteration of the original ultramafic rock.

Petrogenesis

This rock is most likely ultramafic igneous, formed by relatively slow crystallization of magma of mantle origin. The pyrrhotite and pentlandite likely crystallized early followed by olivine and magnetite and finally phlogopite. The magnetite forms rims around the early sulphides. Metamorphism subsequent to crystallization caused the alteration of some of the silicates and possible mobilization of the sulphides, especially the chalcopyrite. Gold may have been introduced during the alteration.

Comments

ROCK NAME: DIATREME(?)

COSMIC VENTURES
Box 4056
Spruce Grove
Alberta, T7X 3B3

PETROGRAPHIC ANALYSIS

Analysis by Maureen Johnston, P.Geol.
CLIENT
GARY JOHNSTON
SPECIMEN NUMBER
89-06-16 (Thin Section)
DATE

Mineralogy

Mineral	%
PLAGIOCLASE	40
ORTHOCLASE	30
QUARTZ	20
MUSCOVITE	10
IRON OXIDE	<1
ZIRCON	trace
	100%

Mineral Descriptions

PLAGIOCLASE: Equant to columnar crystals, approximately 2 mm. in length. Occurs in a matrix of interlocking crystals with orthoclase. Some alteration to clay minerals. Optical Properties: Colorless to pale brown when altered; first order grey interference color with polysynthetic twinning; composition is sodic albite to oligoclase.

ORTHOCLASE: Partly microcline also. Equant crystals, approximately 2 mm. in length. Occurs in matrix of interlocking crystals with plagioclase. Optical Properties: Pale brown from surface alteration to clay minerals; first order grey interference colors; negative relief.

QUARTZ: Anhedal crystals 2-4 mm. in length. Occurs in a matrix of interlocking crystals with the feldspars. Quartz is granulated along grain boundaries and large crystals are fractured internally into a fragmented network. Optical Properties: Colorless in plane light; first order interference colors; extreme undulatory extinction.

MUSCOVITE: Subhedral to euhedral crystals; approximately 2 mm. in length. Becomes sericitic at edges of the crystals, especially where muscovite contacts a feldspar crystal. Optical Properties: Colorless in plane light with dark lines defining cleavage planes; third order interference colors; parallel extinction.

IRON OXIDE: Traces of very fine grained secondary mineral along grain boundaries.

ZIRCON: Occasional euhedral crystal, usually less than 100 microns in length. Optical Properties: Brownish color in plane light; extreme interference colors; extreme relief.

Specimen Number
89-06-16 (Thin Section)

....

Texture

This rock has a phaneritic medium grained texture composed of interlocking equant grains of feldspars and quartz. Fibrous muscovite occurs throughout the matrix.

Alteration

Feldspars show some alteration to secondary clay minerals.
Muscovite is partially altered to sericite, especially along feldspar grain boundaries.
Secondary iron oxide occurs along crystal boundaries.

Petrogenesis

This rock is likely an intrusive igneous formed by slow cooling of a granitic magma or by granitization of felsic sediments. The rock has been subjected to stress either during or subsequent to crystallization and this may have been accompanied by mobilization of potassium and the formation of sericite. The stress resulted in the fracturing/granulation of quartz.

Comments

ROCK NAME: GRANITE

COSMIC VENTURES
Box 4056
Spruce Grove
Alberta, T7X 3B3

PETROGRAPHIC ANALYSIS

....

Analysis by Maureen Johnston, P.Geol.
CLIENT
GARY JOHNSTON
SPECIMEN NUMBER
89-06-25 (Polished Thin Section)
DATE

....

Mineralogy

Mineral	%
OLIVINE	75
PHLOGOPITE	10
PYROXENE	5
SERPENTINE	5
CALCITE	5
PYRRHOTITE	<1
PENTLANDITE	<1
MAGNETITE	<1
SPINEL	<1
CHALCOPYRITE	trace
	100%

Mineral Descriptions

OLIVINE: Rounded grains varying from 500 microns to 2 mm. in diameter. Some alteration to serpentine and secondary calcite. Optical Properties: Light yellow in plane light; upper second order interference colors; cracked texture with alteration along cracks.

PHLOGOPITE: Subhedral to euhedral crystals, up to 2 mm. in length. Occur throughout section. Optical Properties: Light reddish brown pleochroism; upper second to third order interference colors; parallel extinction.

PYROXENE: Probably clinopyroxene. Occurs as subhedral columnar crystals dispersed throughout the section. Optical Properties: Pale green color in plane light; second order interference colors; right angle cleavage.

SERPENTINE: Secondary alteration of olivine. Occurs in cracks throughout olivine crystals. Very fine grained sulphide mineralization occurs mostly within this alteration. Optical Properties: Pale green in plane light; low order grey interference colors; fibrous texture.

CALCITE: Anhedral crystals throughout the section, mostly with altered pyroxene. Optical Properties: Colorless to pale brown in plane light; extreme interference colors; rhombohedral cleavage.

PYRRHOTITE: Small blebs (less than 100 microns) in olivine and serpentine. Optical Properties: Pinkish brown in incident light; slightly pleochroic; anisotropic.

PENTLANDITE: Occurs with pyrrhotite, mostly in serpentine. Optical Properties: Creamy yellow in incident light; isotropic.

MAGNETITE: Small blebs, approximately 50-100 microns, as inclusions within olivine. Optical Properties: Brownish grey in incident light; isotropic.

SPINEL: Picolite variety. Shows alteration to chromite. Optical Properties: Brown color in plane light; anomalous brown interference color.

CHALCOPYRITE: Occasional intergrowth with pyrrhotite and pentlandite. Optical Properties: Lemon yellow in incident light; isotropic to slightly anisotropic.

Specimen Number
89-06-25 (Polished Thin Section)

....

Texture

This rock has a phaneritic fine to medium grained equigranular texture composed of compacted rounded crystals of olivine. Some phlogopite and pyroxene occur at olivine grain boundaries.

Alteration

Olivine is partially altered to serpentine. Sulphide minerals occur within the alteration.

Small spinels show alteration to chromite.

Petrogenesis

This rock is likely ultramafic igneous formed by subsurface crystallization of magma of mantle origin. Some alteration to serpentine has occurred along with mobilization of pyrrhotite/pentlandite. The presence of chrome spinel suggests this rock may have originated as a diatreme.

Comments

ROCK NAME: MICA-BEARING HARZBURGITE(?); DIATREME(?)

COSMIC VENTURES
Box 4056
Spruce Grove
Alberta, T7X 3B3

PETROGRAPHIC ANALYSIS

....

Analysis by Maureen Johnston, P.Geol.
CLIENT
GARY JOHNSTON
SPECIMEN NUMBER
89-06-42 (Polished Thin Section)
DATE

....

Mineralogy

Mineral	%
HORNBLENDE	80
BIOTITE	7
PLAGIOCLASE	5
QUARTZ	5
GRAPHITE	2
MAGNETITE	1
HEMATITE	<1
ZIRCON	<1
RUTILE	<1
	100%

Mineral Descriptions

HORNBLENDE: Likely the variety Pargasite. Occurs as subhedral lathlike medium to coarse grained crystals, 1-4 mm. in length. Some fine grained fibrous amphibole with polysynthetic twinning occurs interstitial between coarse laths. Small rounded quartz occurs as inclusions within hornblende. Optical Properties: Pale green to yellow pleochroism; second order interference colors; inclined extinction; 56/124 cleavage.

BIOTITE: Occurs as euhedral crystals and as anhedral masses, usually at the outer edges of hornblende crystals. Optical Properties: Light to dark reddish brown pleochroism; upper second to third order interference colors; parallel extinction.

PLAGIOCLASE: Anhedral crystals, interstitial between hornblende crystals. Optical Properties: Pale brown to colorless in plane light; low first order interference colors; some polysynthetic twinning.

QUARTZ: Very small, rounded inclusions in hornblende and interstitial between hornblende crystals. Optical Properties: Colorless in plane light; first order interference colors; some undulatory extinction.

GRAPHITE: Euhedral fibrous crystals up to several mm. in length occur at contacts between hornblende and biotite. Optical Properties: Brownish color in incident light; pleochroic; extreme anisotropism.

MAGNETITE: Rounded crystals, varying from 50 to 250 microns. Occur throughout the hornblende, especially at grain boundaries and cleavage contacts. Optical Properties: Brownish grey in incident light; isotropic.

HEMATITE: Very fine grained secondary mineral; usually in fractures. Optical Properties: Reddish color in plane light.

ZIRCON: Occasional euhedral crystal, approximately 100 microns in length. Optical Properties: Brownish red color in plane light; extreme interference colors; high positive relief.

RUTILE: Occasional anhedral rounded crystals. Optical Properties: Reddish color in plane light; anomalous red interference color; high positive relief.

Specimen Number
89-06-42 (Polished Thin Section)

....

Texture

The section is composed of medium to coarse grained crystals of hornblende in random orientation with interstitial biotite, plagioclase, quartz and masses of fibrous amphibole. Euhedral crystals of graphite occur at grain boundaries and small rounded crystals of magnetite occur as inclusions throughout the hornblende.

Alteration

Hornblende appears to be partially altered to biotite.
Hematite occurs as a secondary mineral in fractures.

Petrogenesis

The petegenesis of this rock is difficult to determine from thin section evidence alone. A knowledge of field relationships is required. The rock may be the result of regional metamorphism of a mafic igneous rock or mafic volcaniclastic. Because the hornblende is the pargasite variety, the rock may also be a skarn resulting from metamorphism of siliceous carbonate rocks or may be associated with ultramafics.

Comments

ROCK NAME: AMPHIBOLITE

COSMIC VENTURES
Box 4056
Spruce Grove
Alberta, T7X 3B3

PETROGRAPHIC ANALYSIS

....

Analysis by Maureen Johnston, P.Geol.
CLIENT
GARY JOHNSTON
SPECIMEN NUMBER
89-06-22 (Polished Thin Section)
DATE

....

Mineralogy

Mineral	%
PYROXENE	60
PLAGIOCLASE	20
CHONDRODITE	20
MAGNETITE	<1
RUTILE	<1
BIOTITE	<1
PYRRHOTITE	trace
PENTLANDITE	trace
CHALCOPYRITE	trace
	100%

Mineral Descriptions

PYROXENE: Augite or similar clinopyroxene. Crystals are subhedral lathlike, approximately 1-2 mm. in length. Crystals show zoning and alteration to fibrous amphibole. Optical Properties: Pale green to brownish in plane light; second order interference colors; inclined extinction with large extinction angle; right angle cleavage.

PLAGIOCLASE FELDSPAR: Occurs as anhedral masses interstitial between pyroxene crystals. Optical Properties: Colorless to pale brown in plane light; first order interference colors; polysynthetic twinning suggests calcic composition.

CHONDRODITE: Anhedral masses overgrowing pyroxene. Optical Properties: Colorless to pale yellow in plane light; upper first order to low second order interference colors; biaxial.

MAGNETITE: Occasional rounded crystals, typically 100-500 microns in diameter. Dispersed throughout section. Optical Properties: Brownish grey color in incident light; isotropic.

RUTILE: Occasional anhedral crystals, approximately 500 microns in diameter. Occurs surrounded by biotite. Optical Properties: Red color in plane light; high relief; anomalous birefringence.

BIOTITE: Euhedral crystals surrounding rutile. Optical Properties: Reddish brown to brown pleochroism; anomalous birefringence; parallel extinction.

PYRRHOTITE: Traces of rounded masses, up to 100 microns in diameter. Dispersed throughout the pyroxene. Optical Properties: Pinkish brown in incident light; slightly pleochroic; anisotropic.

PENTLANDITE: Flame-like inclusions in pyrrhotite. Optical Properties: Creamy white in incident light; isotropic.

CHALCOPYRITE: Traces of anhedral crystals, usually associated with the pyrrhotite. Optical Properties: Lemon yellow color in incident light.

Specimen Number
89-06-22 (Polished Thin Section)

....

Texture

This rock is phaneritic medium grained composed of subhedral laths of pyroxene with interstitial anhedral masses of calcic plagioclase feldspar. Most pyroxene crystals have overgrowths of chondrodite.

Alteration

Some alteration of pyroxene to fibrous amphibole.

Petrogenesis

This rock is likely an intrusive igneous mafic to ultramafic. The texture has been modified by later overgrowths of chondrodite. The presence of chondrodite suggests this rock may be a skarn. The sulphide mineralization is associated with the formation of the pyroxene.

Comments

ROCK NAME: GABBRO (?) or PYROXENE-BEARING SKARN

COSMIC VENTURES
Box 4056
Spruce Grove
Alberta, T7X 3B3

PETROGRAPHIC ANALYSIS

Analysis by Maureen Johnston, P.Geol.

CLIENT
GARY JOHNSTON

SPECIMEN NUMBER
89-06-20 (Polished Thin Section)

DATE

Mineralogy

Mineral	%
HORNBLENDE	80
PLAGIOCLASE	5
QUARTZ	5
BIOTITE	5
IRON OXIDE	5
	100%

Mineral Descriptions

HORNBLENDE: Subhedral lathlike crystals, approximately 2 mm. in length. Crude alignment of long dimension of crystals. Hornblende shows alteration to biotite around outer edges. Optical Properties: Green to yellow pleochroism; second order interference colors; inclined extinction; 56/124 cleavage.

PLAGIOCLASE: Masses of granoblastic crystals, interstitial between hornblende laths. Optical Properties: Colorless in plane light; first order interference colors.

QUARTZ: Anhedral crystals interstitial between hornblende laths. Optical Properties: Colorless in plane light; first order interference colors; uniaxial positive.

BIOTITE: Occurs as alteration of hornblende. Optical Properties: Brown to yellow pleochroism; anomalous birefringence; parallel extinction.

IRON OXIDE: Very fine grained alteration; observed along cleavage and fractures in hornblende. Optical Properties: Reddish color in transmitted light; bluish grey in incident light with red internal reflections.

Specimen Number
89-06-20 (Polished Thin Section)

....

Texture

The rock is composed of medium grained subhedral laths of hornblende with interstitial masses of granoblastic plagioclase and quartz. The texture is slightly schistose resulting from crude orientation of hornblende crystals.

Alteration

Hornblende is partially altered to biotite around outer edges. Secondary iron oxide occurs along fractures and cleavages in hornblende.

Petrogenesis

This rock is an amphibolite that likely resulted from regional metamorphism of a mafic source rock, perhaps a volcaniclastic or greywacke. Retrograde alteration has produced minor amounts of biotite.

Comments

ROCK NAME: AMPHIBOLITE

COSMIC VENTURES
Box 4056
Spruce Grove
Alberta, T7X 3B3

PETROGRAPHIC ANALYSIS

....

Analysis by Maureen Johnston, P.Geol.

CLIENT

GARY JOHNSTON

SPECIMEN NUMBER

89-06-26 (Polished Thin Section)

DATE

....

Mineralogy

Mineral	%
OLIVINE	75
SERPENTINE	5
IRON OXIDE	5
PYRRHOTITE	<1
	100%

Mineral Descriptions

OLIVINE: Rounded grains varying from 2 to 4 mm. in diameter. Some alteration to serpentine and secondary calcite. Optical Properties: Light yellow in plane light; upper second order interference colors; cracked texture with alteration along cracks.

SERPENTINE: Secondary alteration of olivine. Occurs in cracks throughout olivine crystals and as thin veins cross cutting rock. Optical Properties: Pale green in plane light; low order grey interference colors; fibrous texture.

PYRRHOTITE: Small blebs (less than 100 microns) in olivine and serpentine and occasional thin stringer. Optical Properties: Pinkish brown in incident light; slightly pleochroic; anisotropic.

IRON OXIDE: Thin veins cross cutting the section. Iron oxide is very fine grained, likely secondary. Optical Properties: Reddish color in transmitted light; bluish grey in incident light with red internal reflections.

Specimen Number

89-06-26 (Polished Thin Section)

Texture

This rock has a phaneritic medium grained equigranular texture composed of compacted rounded crystals of olivine. Thin stringers of serpentine, iron oxide and occasionally pyrrhotite cross cut the rock.

Alteration

Olivine is partially altered to serpentine.

Petrogenesis

This rock is likely ultramafic igneous formed by subsurface crystallization of magma of mantle origin. Some alteration to serpentine has occurred along with mobilization of pyrrhotite.

Comments

ROCK NAME: DUNITE

COSMIC VENTURES
Box 4056
Spruce Grove
Alberta, T7X 3B3

PETROGRAPHIC ANALYSIS

....

Analysis by Maureen Johnston, P.Geol.

CLIENT
GARY JOHNSTON

SPECIMEN NUMBER
89-06-45 (Thin Section)

DATE

....

Mineralogy

Mineral	%
HORNBLENDE	74
PLAGIOCLASE	10
PYROXENE	10
BIOTITE	5
SPHENE	1
	100%

Mineral Descriptions

HORNBLENDE: Subhedral lathlike crystals, approximately 5 mm. in length. Crude alignment of long dimension of crystals. Hornblende shows alteration to biotite around outer edges. Optical Properties: Green to yellow pleochroism; second order interference colors; inclined extinction; 56/124 cleavage.

PLAGIOCLASE: Anhedral crystals, 0.5 to 1 mm. in diameter. Occurs in a layer with pyroxene. Mostly calcic in composition. Optical Properties: Colorless in plane light; first order interference colors.

PYROXENE: Anhedral crystals, approximately 1 mm. in diameter. Some overgrowths of hornblende observed. Pyroxene occurs in a layer along with plagioclase. Optical Properties: Pale green in plane light; second order interference colors; right angle cleavage.

BIOTITE: Occurs as alteration of hornblende and in a thin layer of foliated euhedral crystals. Optical Properties: Brown to yellow pleochroism; anomalous birefringence; parallel extinction.

SPHENE: Euhedral crystals, approximately 1-2 mm. in diameter. Occur throughout the hornblende matrix. Optical Properties:

Reddish brown color in plane light; anomalous birefringence; high relief.

Specimen Number
89-06-45 (Thin Section)

....

Texture

The rock is composed of coarse grained subhedral laths of hornblende. A thin layer of schistose biotite and a thin layer of plagioclase/pyroxene with an equigranular texture cut the hornblende.

Alteration

Hornblende is partially altered to biotite around outer edges. Overgrowths of hornblende occur around pyroxene.

Petrogenesis

This rock is an amphibolite that likely resulted from regional metamorphism of a mafic source rock. The pyroxene granulite layer and schistose biotite layer may represent compositional variation within the original rock. Retrograde alteration has produced minor amounts of biotite around hornblende.

Comments

ROCK NAME: AMPHIBOLITE

COSMIC VENTURES
Box 4056
Spruce Grove
Alberta, T7X 3B3

PETROGRAPHIC ANALYSIS

....

Analysis by Maureen Johnston, P.Geol.

CLIENT
GARY JOHNSTON

SPECIMEN NUMBER
89-02-01 (Polished Thin Section)

DATE

....

Mineralogy

Mineral	%
FELDSPAR	35
PYROXENE	30
MICA	10
QUARTZ	10
CANCRINITE	5
IRON OXIDE	5
CALCITE	4
GRAPHITE	1
SPHENE	trace
PYRRHOTITE	trace
APATITE	trace
ZIRCON	trace
	100%

Mineral Descriptions

FELDSPAR: Both K-feldspar and sodic plagioclase. Crystals are equant to columnar, approximately 1 mm. in length. Occur in equigranular interlocking crystal mass with pyroxene. All feldspars show intense alteration to secondary clay minerals. Optical Properties: Brownish alteration color; low order interference color; plagioclase occasionally shows polysynthetic twinning; microcline shows gridiron twinning.

PYROXENE: Mostly clinopyroxene, diopside or similar composition. Crystals are subhedral columnar, 1-2 mm. in length. Optical Properties: Pale green to colorless in plane light; upper second order interference colors; right angle cleavage; large extinction angle.

MICA: Muscovite to phlogopite in composition. Occurs as elongated fibrous crystals throughout the section. Optical Properties: Colorless to very pale golden in plane light; third order interference colors; parallel extinction.

CANCRINITE ($6NaAlSiO_4.Na_2CO_3$): Elongated anhedral crystals, approximately 2 mm. in length. Occur throughout with the feldspars. Usually an indicator of the presence of nepheline. Optical Properties: Colorless in plane light; second order interference colors; moderate positive relief.

QUARTZ: Stringers of crushed/recrystallized cherty quartz. Optical Properties: Colorless in plane light; first order interference colors; undulatory extinction.

IRON OXIDE: Very fine grained secondary mineral throughout and as pseudomorphs after sulphides.

CALCITE: Anhedral masses, usually associated with cherty layers. Optical Properties: Pale brown to colorless in plane light; extreme birefringence; rhombohedral cleavage.

GRAPHITE: Euhedral crystals dispersed throughout the section; approximately 2 mm. in diameter. Optical Properties: Brownish color in incident light; extreme pleochroism; anisotropic.

PYRRHOTITE/PENTLANDITE: Occasional remnants in iron oxide. Likely more abundant prior to alteration. Optical Properties: Pyrrhotite is pinkish brown in incident light with slight pleochroism and anisotropism; pentlandite is creamy yellow in incident light and occurs as flame-like exsolution lamallae in pyrrhotite.

SPHENE: Occasional euhedral crystal. Optical Properties: Brown color in plane light; high relief; anomalous birefringence.

APATITE: Occasional euhedral crystal. Optical Properties: Colorless in plane light; first order grey interference color; moderate positive relief.

ZIRCON: Occasional euhedral crystal, approximately 250-500 microns in length. Optical Properties: Brownish red color in plane light; high relief; extreme birefringence.

<u>Specimen Number</u>
89-02-01

....

<u>Texture</u>

This rock is composed of fine to medium grained equigranular crystals of feldspar and pyroxene. Fibrous mica and graphite occur dispersed throughout along with traces of pyrrhotite/pentlandite, apatite, zircon and iron oxide. Cancrinite is observed throughout the feldspars and usually suggests the presence of nepheline. No nepheline was detected; however, it may have been altered and not reconizable. Stringers of cherty quartz and calcite cut the section.

Alteration

The feldspars are intensely altered to secondary clay minerals. Sulphides have been altered to secondary iron oxide.

Petrogenesis

This rock is likely the result of high grade thermal metamorphism in the presence of carbonates or accompanied by alkali metasomatism. Nepheline syenite may have been present prior to the metamorphism. Cherty recrystallized quartz occurs as stringers and was likely introduced subsequent to thermal metamorphism.

Comments

ROCK NAME: CALC-SILICATE SKARN

COSMIC VENTURES
Box 4056
Spruce Grove
Alberta, T7X 3B3

PETROGRAPHIC ANALYSIS

....

Analysis by Maureen Johnston, P.Geol.
CLIENT
GARY JOHNSTON
SPECIMEN NUMBER
89-05-18 (Polished Thin Section)
DATE

....

Mineralogy

Mineral	%
FELDSPAR	40
PYROXENE	30
MICA	10
QUARTZ	10
IRON OXIDE	5
CALCITE	4
GRAPHITE	1
SPHENE	trace
PYRRHOTITE	trace
MELILITE	trace
	100%

Mineral Descriptions

FELDSPAR: Both K-feldspar and sodic plagioclase. Crystals are equant to columnar, approximately 1 mm. in length. Occur in equigranular interlocking crystal mass with pyroxene. All feldspars show intense alteration to secondary clay minerals. Optical Properties: Brownish alteration color; low order interference color; plagioclase occasionally shows polysynthetic twinning; microcline shows gridiron twinning.

PYROXENE: Mostly clinopyroxene, diopside or similar composition. Crystals are subhedral columnar, 1-2 mm. in length. Optical Properties: Pale green to colorless in plane light; upper second order interference colors; right angle cleavage; large extinction angle.

MICA: Muscovite to phlogopite in composition. Occurs as elongated fibrous crystals throughout the section. Optical Properties: Colorless to very pale golden in plane light; third order interference colors; parallel extinction.

QUARTZ: Stringers of crushed/recrystallized cherty quartz. Optical Properties: Colorless in plane light; first order interference colors; undulatory extinction.

IRON OXIDE: Very fine grained secondary mineral throughout and as pseudomorphs after sulphides.

CALCITE: Anhedral masses, usually associated with cherty layers. Optical Properties: Pale brown to colorless in plane light; extreme birefringence; rhombohedral cleavage.

GRAPHITE: Euhedral crystals dispersed throughout the section; approximately 2 mm. in diameter. Optical Properties: Brownish color in incident light; extreme pleochroism; anisotropic.

PYRRHOTITE/PENTLANDITE: Occasional remnants in iron oxide. Likely more abundant prior to alteration. Optical Properties: Pyrrhotite is pinkish brown in incident light with slight pleochroism and anisotropism; pentlandite is creamy yellow in incident light and occurs as flame-like exsolution lamallae in pyrrhotite.

SPHENE: Occasional euhedral crystal. Optical Properties: Brown color in plane light; high relief; anomalous birefringence.

MELILITE ($Ca_2Al_2SiO_7$): Occasional fibrous masses. Optical Properties: Colorless in plane light; anomalous blue interference color.

Specimen Number

89-05-18

....

Texture

This rock is composed of fine to medium grained equigranular crystals of feldspar and pyroxene. Fibrous mica and graphite occur dispersed throughout along with traces of pyrrhotite/pentlandite and iron oxide. Stringers of cherty quartz and calcite cut the section.

Alteration

The feldspars are intensely altered to secondary clay minerals.

Petrogenesis

This rock is likely the result of high grade thermal metamorphism in the presence of carbonates or accompanied by alkali metasomatism.

Comments

ROCK NAME: CALC-SILICATE SKARN

COSMIC VENTURES
Box 4056
Spruce Grove
Alberta, T7X 3B3

PETROGRAPHIC ANALYSIS

....

Analysis by Maureen Johnston, P.Geol.

CLIENT

GARY JOHNSTON

SPECIMEN NUMBER

90-02-28 A (Polished Thin Section)

DATE

....

Mineralogy

Mineral	%
HORNBLENDE	82
PLAGIOCLASE	10
QUARTZ	5
SPHENE	<1
HEMATITE	<1
ILMENITE	<1
CHALCOPYRITE	trace
	100%

Mineral Descriptions

HORNBLENDE: Likely the variety Pargasite. Occurs as subhedral lathlike medium to coarse grained crystals, 1-2 mm. in length. Some fine grained fibrous amphibole with polysynthetic twinning occurs interstitial between coarse laths. Small rounded quartz occurs as inclusions within hornblende. Optical Properties: Pale green to yellow pleochroism; second order interference colors; inclined extinction; 56/124 cleavage.

PLAGIOCLASE: Anhedral crystals, interstitial between hornblende crystals. Optical Properties: Pale brown to colorless in plane light; low first order interference colors; some polysynthetic twinning.

QUARTZ: Very small, rounded inclusions in hornblende and interstitial between hornblende crystals. Optical Properties: Colorless in plane light; first order interference colors; some undulatory extinction.

SPHENE: Euhedral crystals, approximately 250 microns in length. Dispersed throughout the section. Small blebs of ilmenite occur within sphene crystals. Optical Properties: Brown color in plane light; anomalous birefringence; high relief.

ILMENITE: Rounded crystals, varying from 5 to 50 microns. Occur throughout the sphene. Optical Properties: Brownish grey in incident light; isotropic or slightly anisotropic.

HEMATITE: Very fine grained secondary mineral; usually in fractures with remnants of chalcopyrite. Optical Properties: Reddish color in plane light.

CHALCOPYRITE: Traces in hematite masses. Optical Properties: Lemon yellow color in incident light; isotropic to slightly anisotropic.

Specimen Number
90-02-28A (Polished Thin Section)

....

Texture

The section is composed of medium grained crystals of hornblende with foliation resulting from orientation of long dimension of the crystals. Plagioclase, quartz and masses of fibrous amphibole occur interstitial between hornblende laths. Euhedral crystals of sphene occur throughout with inclusions of small rounded crystals of ilmenite.

Alteration

Hornblende appears to be partially altered to fibrous minerals. Hematite occurs as a secondary mineral in fractures.

Petrogenesis

The petrogenesis of this rock is difficult to determine from thin section evidence alone. A knowledge of field relationships is required. The rock may be the result of regional metamorphism of a mafic igneous rock or mafic volcaniclastic. Because the hornblende is the pargasite variety, the rock may also be a skarn resulting from metamorphism of siliceous carbonate rocks or may be associated with ultramafics.

Comments

ROCK NAME: AMPHIBOLITE

COSMIC VENTURES
Box 4056
Spruce Grove
Alberta, T7X 3B3

PETROGRAPHIC ANALYSIS

....

Analysis by Maureen Johnston, P.Geol.

CLIENT
GARY JOHNSTON

SPECIMEN NUMBER
90-02-28 B (Polished Thin Section)

DATE

....

Mineralogy

Mineral	%
PYROXENE	67
GARNET	15
CALCITE	10
QUARTZ	5
APATITE	<1
IRON OXIDE	<1
CHALCOPYRITE	<1
	100%

Mineral Descriptions

PYROXENE: Subhedral columnar crystals, 2-5 mm. in length. Occur in a granulose texture. Optical Properties: Pale green in plane light; second order interference colors; large extinction angle.

GARNET: Anhedral crystals, 1-5 mm. in diameter. Occurs througout, interstitial between pyroxene crystals. Optical Properties: Pink color in plane light; isotropic; high relief.

CALCITE: Coarse anhedral masses interstitial between pyroxene crystals. Optical Properties: Pale brown to colorless in plane light; extreme birefringence; rhombohedral cleavage.

QUARTZ: Anhedral granoblastic masses of crystals, interstitial between pyroxene crystals. Optical Properties: Colorless in plane light; first order interference colors.

APATITE: Euhedral crystals, approximately 1 mm. in length. Occurs as inclusions in calcite and occasionally garnet. Optical Properties: Colorless in plane light; first order interference colors; moderate positive relief.

IRON OXIDE: Occasional masses, usually within pyroxene. Occurs along with remnants of chalcopyrite. Optical Properties: Reddish color in plane light; bluish grey in incident light with red internal reflections.

CHALCOPYRITE: Irregular remnants within iron oxide masses. Optical Properties: Lemon yellow color in incident light; slightly anisotropic.

Specimen Number
90-02-28 B (Polished Thin Section)

....

Texture

The section is composed of medium to coarse grained columnar crystals of pyroxene with a granulose texture. Anhedral garnet, calcite and quartz occur interstitial between pyroxene.

Alteration

Chalcopyrite is only observed as small remnants within masses of iron oxide.

Petrogenesis

This rock occurs in contact with schistose amphibolite (90-02-28A). The rock may be a skarn resulting from the introduction of calcite into mafic/ultramafic rocks.

Comments

ROCK NAME: CALCSILICATE SKARN ?

COSMIC VENTURES
Box 4056
Spruce Grove
Alberta, T7X 3B3

PETROGRAPHIC ANALYSIS

Analysis by Maureen Johnston, P.Geol.

CLIENT
GARY JOHNSTON

SPECIMEN NUMBER
90-04-22 (Polished Thin Section)

DATE

Mineralogy

Mineral	%
PYROXENE	77
NEPHELINE	10
CALCITE	5
MAGNETITE/ILMENITE	5
APATITE	<1
CHALCOPYRITE	<1
	100%

Mineral Descriptions

PYROXENE: Subhedral columnar crystals, 2-5 mm. in length. Occur in a granulose texture. Optical Properties: Pale green in plane light; second order interference colors; large extinction angle.

NEPHELINE: Subhedral columnar crystals, approximately 1 mm. in length occur in thin stringers and interstitial between pyroxene crystals. Intense alteration to secondary clay minerals. Optical Properties: Very dirty brown alteration surface in plane light; first order interference color; uniaxial negative.

CALCITE: Coarse anhedral crystals in a vein between pyroxene crystals. Optical Properties: Pale brown to colorless in plane light; extreme birefringence; rhombohedral cleavage.

MAGNETITE/ILMENITE: Elongated crystals in calcite vein. Optical Properties: Pale pink and grey in incident light; slightly anisotropic.

APATITE: Euhedral crystals, approximately 1 mm. in length. Occurs as inclusions in calcite. Optical Properties: Colorless in plane light; first order interference colors; moderate positive relief.

CHALCOPYRITE: Irregular crystals within pyroxene crystals, usually along fractures or cleavage. Optical Properties: Lemon yellow color in incident light; slightly anisotropic.

Specimen Number
90-04-22 (Polished Thin Section)

....

Texture

The section is composed of medium to coarse grained columnar crystals of pyroxene with a granulose texture. Stringers of nepheline occur throughout and a calcite vein hosts elongated crystals of intergrown magnetite and ilmenite.

Alteration

Nepheline is intensely altered to secondary clay minerals.

Petrogenesis

This rock may be an igneous intrusive associated with carbonatites and nepheline complexes or a high grade metamorphic. It is similar to 90-02-28B except that this rock contains nepheline while 28B had abundant garnet interstitial with pyroxene.

Comments

ROCK NAME: IJOLITE ?

COSMIC VENTURES
Box 4056
Spruce Grove
Alberta, T7X 3B3

PETROGRAPHIC ANALYSIS

Analysis by Maureen Johnston, P.Geol.
CLIENT
GARY JOHNSTON
SPECIMEN NUMBER
90-03-09 (Polished Thin Section)
DATE

Mineralogy

Mineral	%
CALCITE	83
FIBROUS AMPHIBOLE	10
OLIVINE	5
SPHENE	2
	100%

Mineral Descriptions

CALCITE: Coarsely crystalline anhedral calcite; well developed cleavage and occasional rhombohedral twinning. Optical Properties: Colorless to pale brown in plane light; extreme birefringence; rhombohedral cleavage.

FIBROUS AMPHIBOLE: Very long euhedral crystals, > 1 cm. Dispersed throughout the calcite matrix. Likely actinolite. Optical Properties: Pale green and slightly pleochroic in plane light; second order interference colors; inclined extinction, approximately 20°.

OLIVINE: Rounded crystals, approximately 1 mm. in diameter. Intensely fractured with calcite occupying region between crystal fragments. Optical Properties: Colorless in plane light; upper second to third order interference colors; high relief.

SPHENE: Subhedral crystals, approximately 2 mm. in length. Dispersed throughout the calcite matrix. Optical Properties: Brown color in plane light; anomalous birefringence; high relief.

Specimen Number
90-03-09

....

Texture

The section is composed of fractured crystals of olivine in a matrix of coarsely crystalline calcite with fibrous amphibole and sphene dispersed throughout.

Alteration

Dynamic alteration of olivine crystals into fragments is the only alteration.

Petrogenesis

This rock may have been an ultramafic igneous (dunite) that has been fractured and replaced by calcite, fibrous amphibole and sphene.

Comments

ROCK NAME: SKARN ?

APPENDIX D

COST STATEMENT

COST STATEMENT

Sept. 25 to 27 / 1989

Geological Sampling

Gary Johnston (Geophysicist) 2 days X $300/day....	600.00
Ray Jalbert (Technologist) 2 days X $150/day......	300.00
Motel (1 day).......................................	49.68
Meals (2 days)......................................	27.30
Travel - 1160 km X .25/km...........................	290.00
Subtotal	1266.98

May 28 to June 8 / 1990

Geology, Geophysics, Gridding

Gary Johnston (Geophysicist) 12 days X $300/day...	3600.00
Ray Jalbert (Technologist) 12 days X $150/day.....	1800.00
Magnetometer rental 5 days X $50/day............	250.00
Gamma Ray Spectrometer rental 2 days X $25/day...	50.00
Food and accommodation (camp) 24 man days X $25/day..........................	600.00
Travel 1160 km X .25/km.........................	290.00
Subtotal	6590.00

June 21 to June 28, July 5 /1990

Prospecting, Gridding, Geology, Geophysics

Gary Johnston (Geophysicist) 9 days X $300/day....	2700.00
Ray Jalbert (Technologist) 9 days X $150/day......	1350.00
Magnetometer rental 3 days X $50/day............	150.00
Gamma Ray Spectrometer rental 3 days X $25/day..	75.00
Food and accommodation (camp) 18 man days X $25/day.........................	450.00
Travel 1/2 X 1160 km X .25/km (Shared with work on another claim)...............................	145.00
Subtotal	4870.00

July 19 to July 23, July 26, 27 / 1990

Geology, Prospecting, Trenching

Gary Johnston (Geophysicist) 6 days X $300/day....	1800.00
Ray Jalbert (Technologist) 6 days X $150/day......	900.00
Trenching - backhoe..............................	480.00
Food and accommodation (camp) 12 man days X 25.00/day.........................	300.00
Travel 1/2 X 1160 km X .25/km (Shared with work on another claim)..................................	145.00
Subtotal	3625.00

Report Preparation

Gary Johnston (Geophysicist) 3 days X $300/day....	900.00
Maureen Johnston (Geologist) Hand Specimen Examination 2 days X $300/day..................	600.00
Supplies (Photocopies, paper, etc.)..............	100.00
Field Supplies (Flagging, stakes, batteries).....	100.00
Phone and Postage................................	25.00
Geochemical Analysis.............................	1097.20
Petrographic Analysis............................	1185.00
Subtotal	4007.20

TOTAL EXPLORATION COST..........$20359.18

APPENDIX E

STATEMENTS OF QUALIFICATION

STATEMENT OF QUALIFICATIONS

I, Maureen D. Johnston of Box 4056, Spruce Grove in the Province of Alberta, hereby certify as follows:

1. That I graduated from the University of Alberta in 1968 with a B.Sc. (Honours) in Geology.

2. That I graduated from the University of Western Ontario in 1971 with an M.Sc. in Geochemistry and Mineralogy.

3. That I have prospected and actively pursued geology and mineralogy prior to my graduation and have practiced the profession of geology since 1968.

4. That I am a partner in Cosmic Ventures, a geophysical and geological consulting company with offices located near Spruce Grove, Alberta (APEGGA Permit # P4469).

5. That I am a professional geologist licensed in the Province Alberta.

Dated the 19th day of August, 1990 at Spruce Grove in the Province of Alberta.

Maureen D. Johnston, P. Geol.

STATEMENT OF QUALIFICATIONS

I, Ray Jalbert of 5609-54 Ave, St. Paul in the Province of Alberta, hereby certify as follows:

1. That I graduated from the Northern Alberta Institute of Technology in 1978 with a diploma in the Earth Resources Program (Minerals Option).

2. That I am a member of the Alberta Society of Engineering Technologists. (C.E.T.)

3. That I have prospected since 1979 in Alberta, the Northwest Territories and British Columbia.

4. That I have extensive experience in the Petroleum Exploration industry.

5. That I have worked for the geophysical consulting company Cosmic Ventures doing various geophysical surveys.

6. That I am a member of the Edmonton Geological Society.

Dated the 6th day of October, 1990 at St. Paul in the Province of Alberta.

Ray Jalbert

STATEMENT OF QUALIFICATIONS

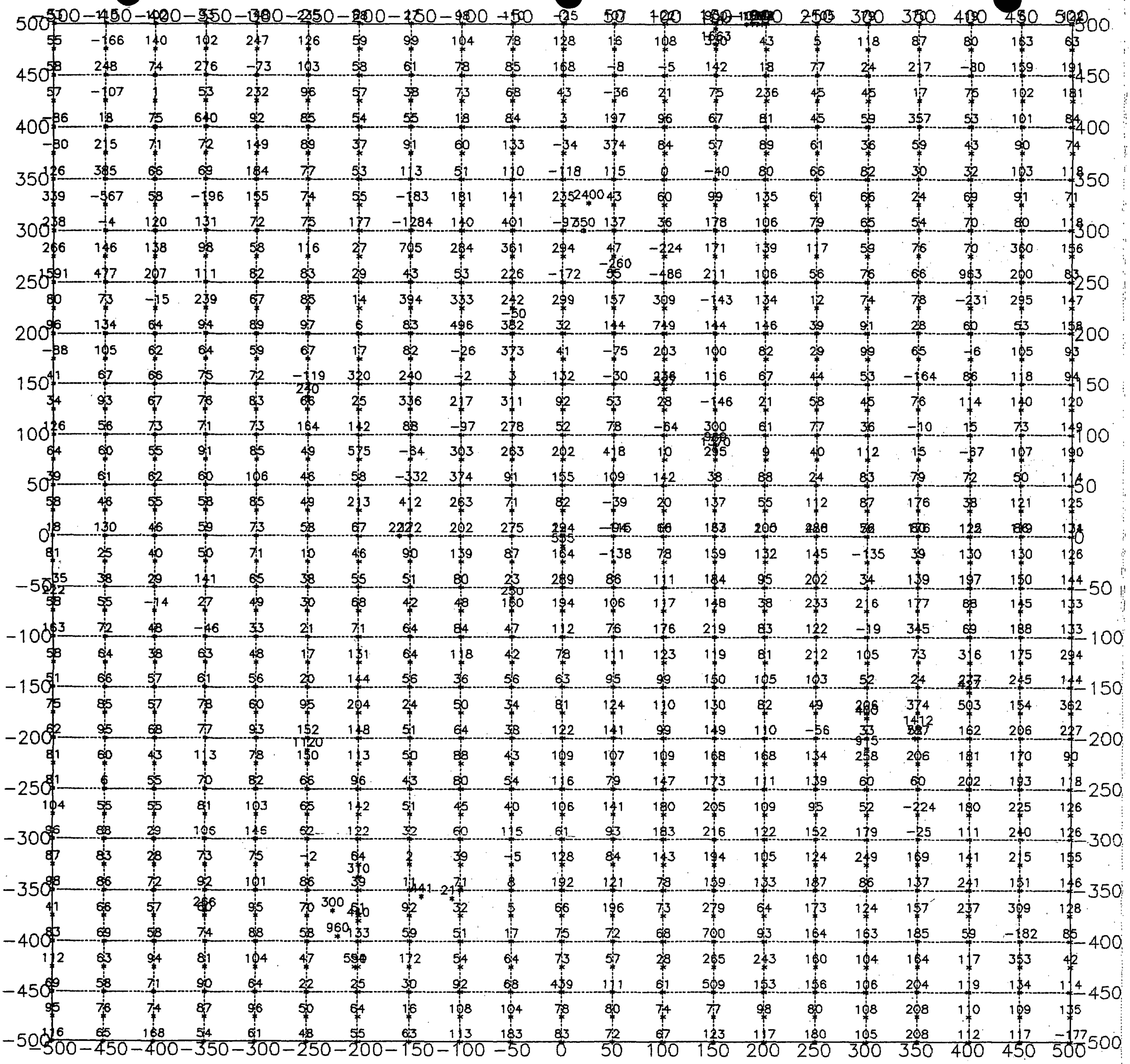
I, Gary L. Johnston of Box 4056, Spruce Grove in the Province of Alberta, hereby certify as follows:

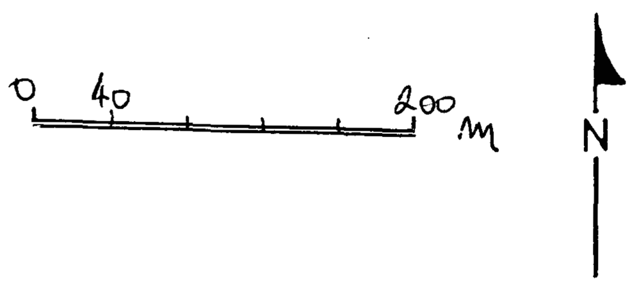
1. That I graduated from the University of Alberta in 1966 with a Bachelor of Science Degree in Physics.
2. That I have prospected and actively pursued geology and geophysics prior to my graduation and have practiced the profession of geophysics since 1966.
3. That I have worked in the area of geophysical research, geophysical exploration and have taught geophysics for many years.
4. That I am a partner in Cosmic Ventures, a geophysical and geological consulting company with offices located near Spruce Grove, Alberta (APEGGA Permit # P4469).
5. I am a Professional Geophysicist licensed in the Province of Alberta.

Dated the 28th day of September, 1990 at Spruce Grove in the Province of Alberta.

Gary Johnston

Gary L. Johnston, P. Geoph.



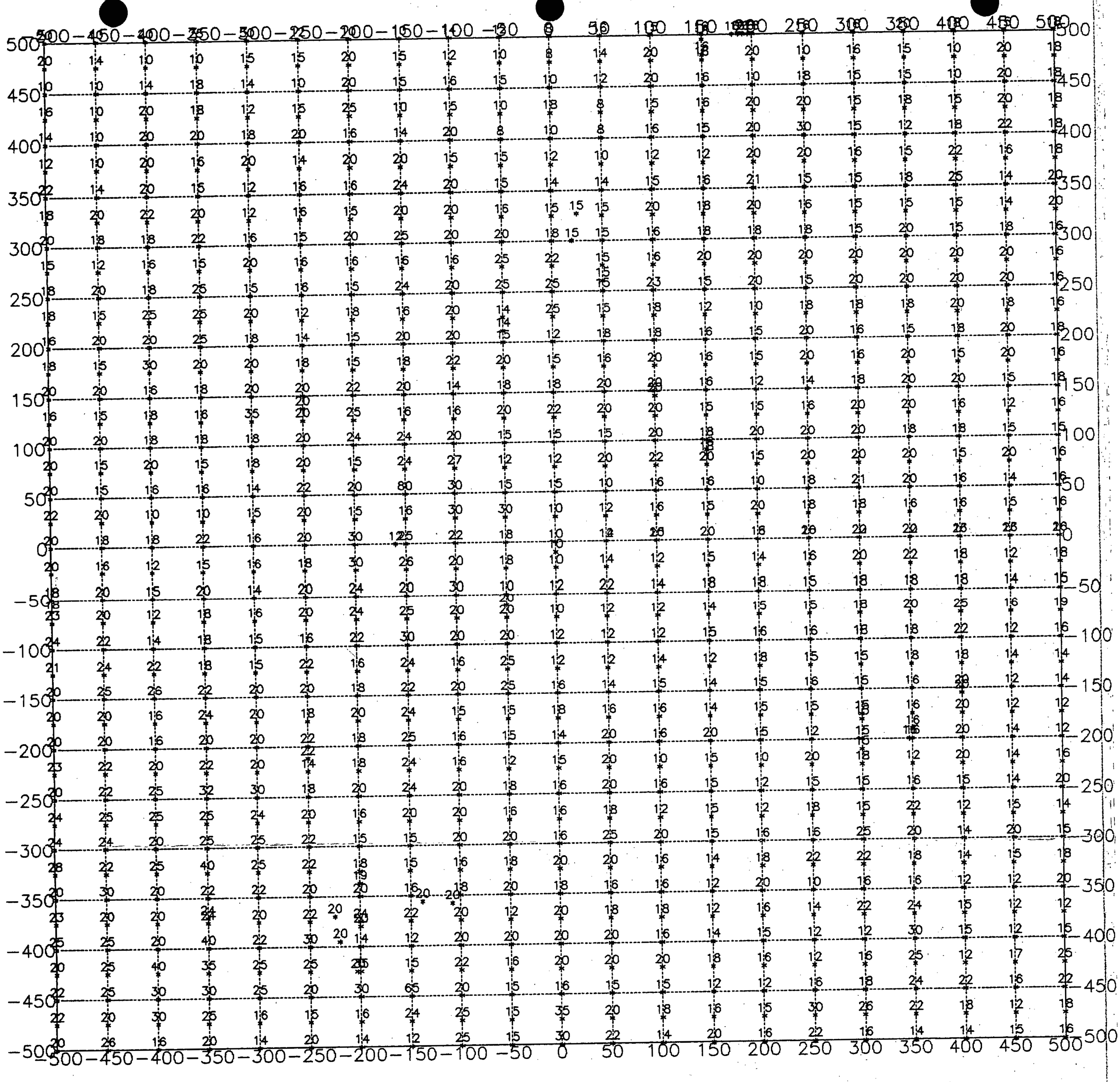


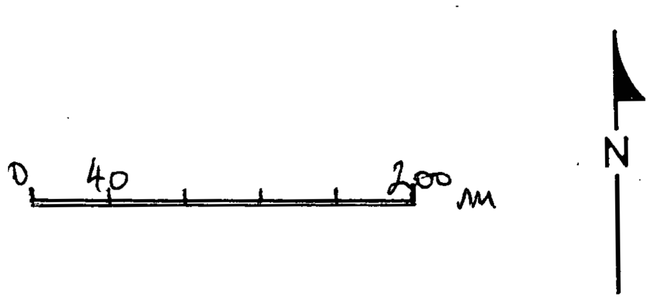
COSMIC VENTURES

ORION GROUP

POSTED MAGNETIC VALUES
Units - nanoTesla
(Datum - 58000 nT)

DRAWN BY G.J.	SCALE 1:4000	
DATE 91-04-29	JOB NO.	MAP NO. 4



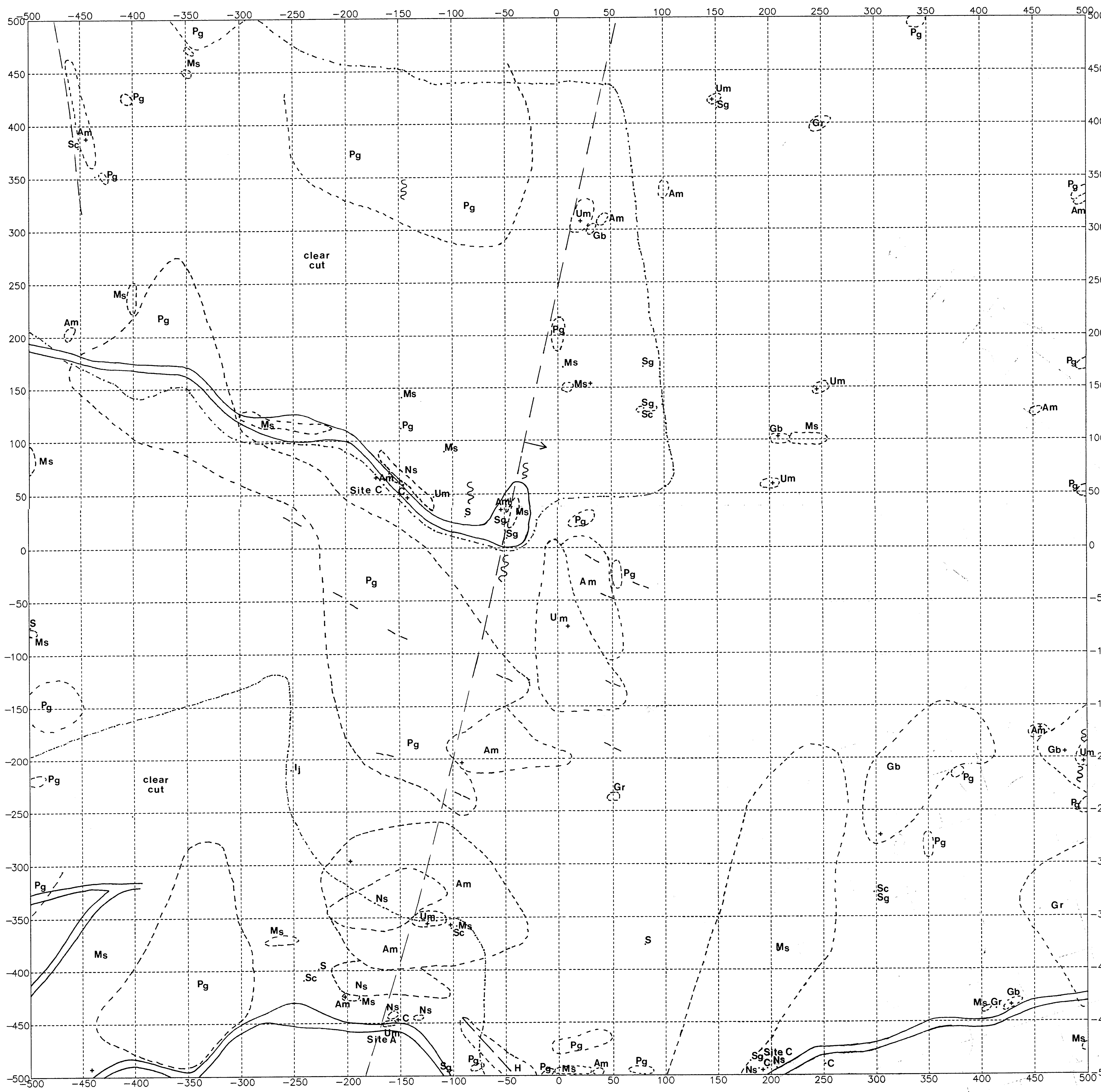


COSMIC VENTURES

ORION GROUP

POSTED RADIOMETRIC VALUES
Units - Counts per Second

DRAWN BY G.J.	SCALE 1:4000	
DATE 91-04-29	JOB NO.	MAP NO. 5



LEGEND

Roads	
Edge clear cut	
Fault	
Inferred contacts	
Cliff	
Evidence of shearing	
Visible sulphides	+
Pegmatite	Pg
Amphibolite	Am
Nepheline Syenite	Ns
Ultramafic	Um
Skarn	S
Skarn with graphite	Sg
Skarn with chalcopyrite	Sc
Granite	Gr
Gabbro	Gb
Metasediment	Ms
Ijolite	Ij
Carbonatite	C
Hydrothermal area	H

ICAL BRANCH
MENT REPORT

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N

0 20 100 M

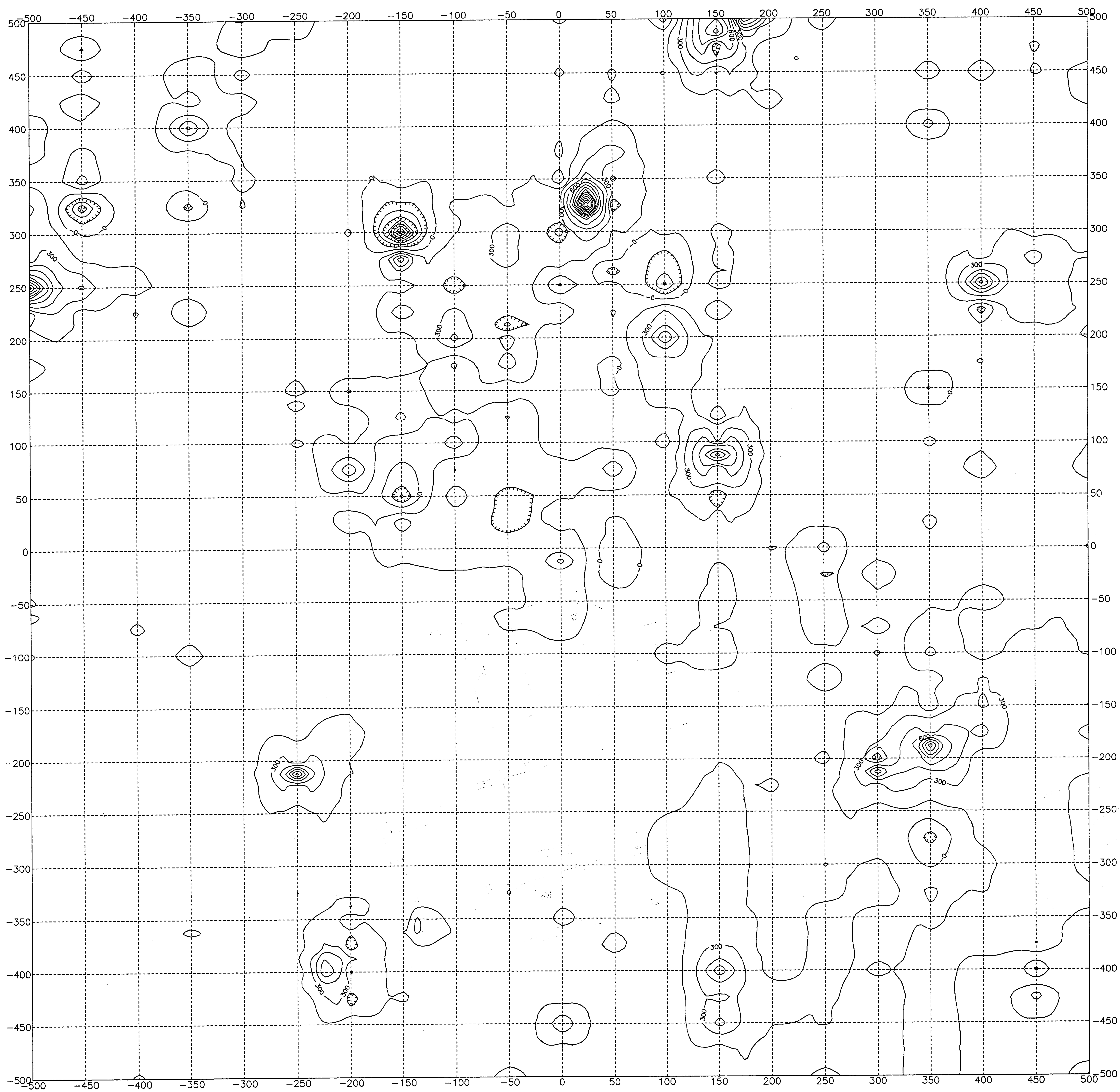
COSMIC VENTURES

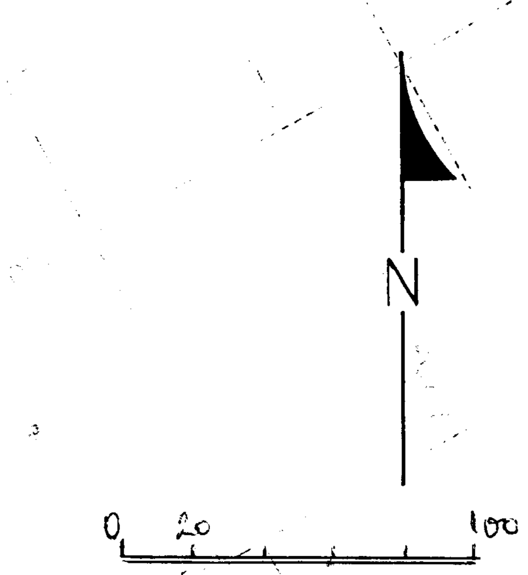
ORION GROUP

GEOLOGY MAP

Outcrop Samples

DRAWN BY G.J.	SCALE 1.2000	
DATE 90-11-13	JOB NO.	MAP NO. 1





GEOLOGICAL BRANCH
ASSESSMENT REPORT

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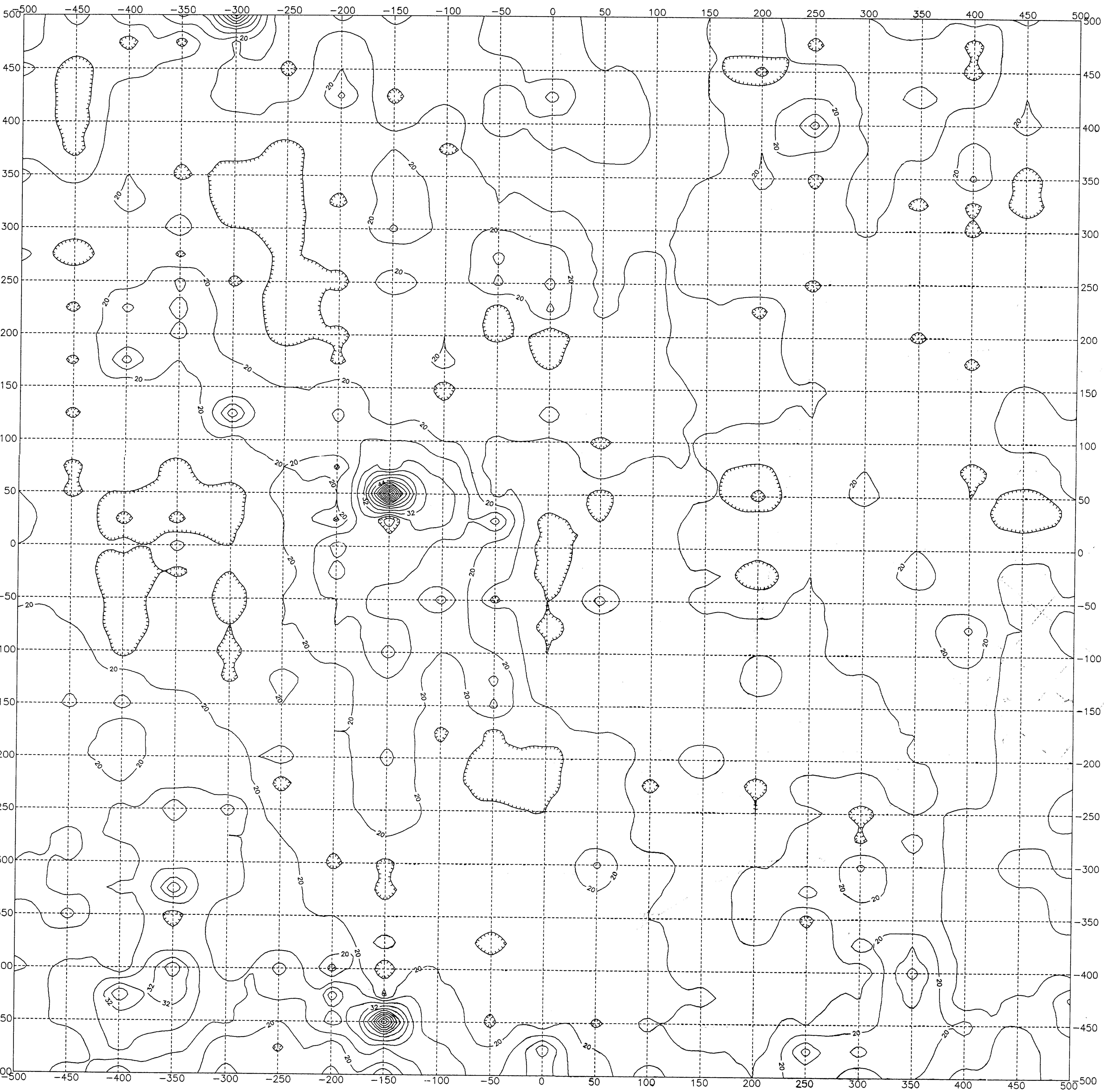
COSMIC VENTURES		
ORION GROUP		
GROUND MAGNETIC MAP		
Units - nanoTesla (Datum - 58000 nT)		
DRAWN BY G.J.	SCALE 1:2000	Int. 150nT
DATE 90-11-13	JOB NO.	MAP NO. 2



GEOLOGICAL BRANCH
ASSESSMENT REPORT

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COSMIC VENTURES		
ORION GROUP		
RADIOMETRIC MAP Units - counts per second Total Channel		
DRAWN BY G.J.	SCALE 1:2000	Int. 4 cps
DATE 90-11-13	JOB NO.	MAP NO. 3